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REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1872.

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REPORT

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THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 15, 1872.

SIR: A single year's experience at the head of this Department convinces me of its importance as an executive branch of the Government. There is none other whose relations to the whole people of the country are so intimate and so constant. The several divisions of the Department are in their operations and uses so naturally connected with the diversified pursuits of practical life, that they cannot fail to greatly aid and give a right direction to the farmer, the gardener, the merchant, and the miner, in all those points of interest which concentrated knowledge is enabled to impart to those whose means of information are limited to the narrow sphere of their individual operations. The minds of men, all over the world, are constantly employed in the search after human knowledge in all that concerns the fruitfulness of the earth as well as the philosophical principles which govern its mysterious operations; and it is the province of this Department to mark well the progress that is made and keep its constituents advised of its value, and how they may avail themselves of advantages to be gained. With the immense and almost measureless extent of this country as a field for agricultural employment, we must not fail to watch, learn, and carefully examine whatever may promise to add to the sum of that human happiness which springs from the carefully cultivated earth. When we call to remembrance the large proportion of the world's inhabitants who depend upon agricultural pursuits for their support in life, it gives us encouragement to believe that the work we do reaches further and strikes deeper into the interests of mankind than comes within the scope of any other human effort. It behooves this Government to be foremost in teaching those lessons of progressive, practical, and scientific agriculture, in accordance with the measure of the great opportunities which we possess to learn them as they occur.

In my last annual report I took occasion to congratulate the country that Congress, by the act of July 2, 1862, had provided for "the establishment of colleges for the benefit of agriculture and the mechanic arts," thereby recognizing the necessity and laying the corner-stone of a system of education which would tend to elevate the farmer to the

standard of knowledge which now distinguishes the other professions of life. It is gratifying to know that these institutions appreciate the effort the Department makes to co-operate with them in the promotion of a knowledge of scientific agriculture, and promise to communicate promptly all facts which may be developed by experiment or otherwise, and which, through its instrumentality, may be published for the information of the whole people. The monthly publications which emanate from the Department, and which are widely circulated among the agricultural journals and farmers of the country, keep them advised with regard to all valuable facts, or even plausible theories, which tend to enlighten the public mind on agricultural subjects.

A careful study of the organization of this Department has led me to the conclusion that its component parts are judiciously associated and admirably adapted to the promotion and care of the agricultural interests of the country.

The Chemical Division is constantly engaged in the investigation of subjects of vital importance to the successful and economical operations of the farm. Mineral fertilizers, as they are found in various localities, are analyzed, and their comparative values are ascertained and pointed out. A knowledge of the intrinsic values of vegetable and animal manures is of the first importance in the economy of the farm. To know the constituent properties of alkaline deposits, ammoniated bone, and similar substances, greatly conduces to their profitable use. The comparative value of plants, as the same may be found to contain substances usefully employed in the mechanic arts, commands the attention of this division whenever there is a prospect of the development of any new branch of enterprise. The increasing correspondence with this division of the Department very clearly indicates a corresponding increase in the interest which the farming communities take in the scientific phase of their art.

It is the province of the Botanical Division to give attention to inquiries for information on questions relating to practical and economic botany. Many of these questions relate to the nature or qualities of various plants; sometimes on account of their prevalence as weeds, which threaten injury; sometimes on account of grasses, which, in certain localities, intrude and extend themselves, and which the farmer is at a loss to know whether to regard as a friend or foe; sometimes in relation to plants which have been supposed to be poisonous; often seeking information as to those best adapted to particular localities, and submitting for examination certain plants which furnish fiber of a character fit for the manufacture of paper or cordage; answers to which put the farmer into the possession of knowledge which he may turn to a practical and profitable account.

The Division of Entomology covers that great and increasingly important subject of insects injurious to vegetation. There is no subject to which the farmer is so much alive, and in which his apprehensions

are so much excited, as that of the depredation of insects upon his growing crops, fruits, and vegetables; and, strange as it may seem, there is no other about which he knows so little, and, therefore, against which he is so helpless to make provision. It is the province of this division to point out such insects as are injurious—their depredations, their habits—how they may be known by their works, and, in some measure, suggesting remedies for the evils of which they are the cause.

The Horticultural Division contributes very largely to the gratification and satisfaction which the public derive from the workings of this Department. To select the best fruits, and improve them by hybridization—to note the peculiarities of varieties and their climatic adaptations—is part of the work of this division. There is no other existing influence which can, with the same facility, collect, for the benefit of the community, the choice fruits and plants of the world. All officers of our Government abroad take great pleasure in furnishing the Department with anything that is new and useful.

The Microscopic Division is growing in importance in a measure commensurate with the discoveries which the power of the glass is constantly developing to the seeker after knowledge. To know the nature of rust, smut, mildew, mold, and kindred causes of vegetable disease, is the first step toward preventing their effects, so detrimental to farmers and fruit-growers. The microscope presents these so plainly to the eye as to remove all doubt of their nature, and leaves nothing to speculate about but the means of prevention.

"To procure, propagate, and distribute new and valuable varieties of seeds and plants," is the work designated by the act of Congress for the Seed Division. With the foreign correspondents and the agents of the Department in most of the counties of the United States, it is constantly kept advised of everything that is new and useful with regard to seeds, and the climate to which they are best suited; and these are procured and distributed among the farmers of the district the location of which is adapted to the quality of the seed; and thus all that is excellent, fruitful, and profitable is put into the hands of our own people, who measure its value and profit by its use.

The Statistical Division is engaged, through the instrumentality of perhaps six thousand agents, in collecting current agricultural statistics, and utilizing all the statistics of governments, associations, and corporations, foreign and domestic, so far as they relate to rural economy and tend to the advancement of American agricultural interests; and this information is published periodically, whereby the farmer is duly informed as to amount of products, the merchant as to their probable value, and the mechanic as to the cost of living.

The Library of the Department is peculiarly an agricultural one, in which are collected the published discussions and studied wisdom of learned men on agriculture. This is turned to a most profitable account by all those whose duties in the Department require their inves-

tigation into agricultural subjects. Here, too, there is supplied the current knowledge and experience of the day. And while the services of all who are competent are constantly brought into requisition to make up the monthly publications of the Department, all information, foreign and domestic, is thus utilized, and, through the instrumentality of agricultural and secular journals, is put into the hands of the farming community.

It will thus be seen that the framers of the organic law which established this Department wisely foresaw the necessity for making provision to promote and foster a great interest, which those who are engaged in it, because of the isolated nature of their employment, could not do for themselves. The whole people of the earth are dependent for their existence upon the products of the soil; and every improvement which tends to the increase of those products multiplies the wealth and happiness of mankind to a degree greater than any other operation of life, measured by the much greater number of those engaged in it.

The operations of the Department for the past year have been enlarged commensurately with the increased appropriation which it was the pleasure of Congress to make at its last session for the distribution of seeds; and I speak advisedly when I declare that there is no part of the work of the Department which is so unqualifiedly approved, and none, I am sure, which works so large a benefit to public interests. The farmer has no means of acquiring a knowledge of the existence of improved seeds, nor of obtaining them if he had. It has been a special employment of this Department to seek and obtain seeds of a superior quality, appropriate them to the climate best adapted to their profitable use, and place them in the hands of the careful cultivator, upon the sole condition that he will correctly advise the Department of their success or failure.

Ramie and jute, fibrous plants which promise great value, have recently been introduced into the United States, and to some extent have been distributed by the Department in the Southern States, the climate of which is alone adapted to their successful production. Of the former, little progress has been made in its use, because machinery has not been invented by which its fiber may be separated; but its value, in view of its fineness, strength, and beauty, will yet command an exercise of ingenuity which will make its culture a profitable industry. The latter has already taken its place in the manufacture of carpets and other fabrics as a substitute for cotton, wool, flax, and hair. Each of these, I may safely predict, is destined to occupy an important place in the products and manufactures of this country; and it is not the least important consideration that they may serve largely to diversify the crops of our Southern States, a subject which has commanded much of my attention because of my conviction of the many benefits which will result therefrom.

It has been my purpose to accomplish all the work of the Department through the instrumentality of its immediate employés, and it affords me great pleasure to say that they are quite equal to the task, and are now so completely organized as to require no further aid. Special subjects sometimes present themselves, and so concern our agricultural interests as to require the consideration and discussion of the professional scholar, and under such circumstances I do not fail to bring into common use the fruits of their study and learning.

I should not fail to note the marked change which has been wrought during the past few years in the appreciation which all classes of society now bestow upon the principles of science as applicable to their several employments. Congress, keeping pace with this expression of public sentiment, at its last session made a liberal appropriation for "a system of observations and reports, in charge of the Chief Signal-Officer of the Army, for such stations, reports, and signals as may be found necessary for the benefit of agriculture and commercial interests," thus responding to the universal sentiment, "God speed the plow."

I cannot close this report without referring to the earnest interest which this Department has taken to induce Congress to adopt active measures to protect the yet existing forests of the country, and to induce their planting on prairies where they are so much needed; and I take this occasion to suggest that no part of the public lands should be disposed of without the condition that a tenth of it should be reserved in timber where it exists; and where it does not exist, that inducements should be offered for planting it. The importance of this subject demands immediate attention.

With regard to the publications of this Department, it has been my constant effort to avoid any delay which would depreciate their value, and I have great satisfaction in saying that this effort has been fully appreciated by the Congressional Printer, whose part of the work has always been promptly and efficiently done.

The total amount appropriated to this Department for the fiscal year ended June 30, 1872, was $197,070; $16,451.44 of this amount was expended by my predecessor, and of the balance I have expended $179,339.74, as follows:

Salaries	$68,814 97
Collecting statistics	13,074 86
Purchase and distribution of seeds and plants	45,000 00
Experimental garden	9,292 04
Contingent expenses	12,464 03
Furniture, cases, and repairs	4,514 50
Museum and herbarium	2,000 00
Library	1,909 69
Laboratory	2,969 65
Improvement of grounds	19,300 00
	179,339 74

Leaving a balance unexpended of $1,278.82. This amount will cover all

unsettled bills incurred by the Department during the last fiscal year, and leave a small balance to return to the United States Treasury.

The amount appropriated for the current fiscal year is $202,440. Of this amount, I expended to September 30, 1872, $42,495.34, leaving a balance unexpended at that date of $159,944.66. The estimates for the next fiscal year are based on the operations of the Department during the current year.

I have the honor to be, very respectfully, your obedient servant,

FREDERICK WATTS,

Commissioner of Agriculture.

His Excellency U. S. GRANT, *President.*

REPORT OF THE STATISTICIAN.

SIR: I submit herewith my eighth annual report as Statistician of the Department of Agriculture. The statistical field to be explored extends through the length and breadth of this country, in all its varied and constantly widening range of rural industries; and frequent incursions into foreign fields are necessary for the introduction of new ideas in production and its processes, and for a knowledge of deficiencies in foreign production and their supply from our own surplus, so far as it can be accomplished with profit to ourselves. With our increasing population, an increasing proportion of those engaged in agriculture,* and, by reason of mechanical aids, a larger result for the manual labor employed, production of certain crops so much exceeds the demand as to render unprofitable, in years of abundance, the labor and capital employed. It is not strange, therefore, that the States essentially agricultural in their industry should appreciate the necessity of seeking new channels of effort, modifications and extensions of the primitive and crude in agricultural labor, yielding products of higher value in proportion to weight, and better able to bear competition with incoming commodities, while molding surplus production to a form defying the ordinary exactions of transportation monopoly. It is important to know, early and accurately, the facts of foreign harvests, that any extraordinary deficiency in breadstuffs may be supplied from our abundance, not only as a means of profit, but from considerations of humanity and international comity; but the business of exporting the raw products of agriculture, as a permanent reliance, has neither the sanction of sound national economy nor the slightest consistency with agricultural progress. It is the province of statistics to present facts, from home and foreign sources, to show the relations of supply and demand and the cost and profit of various branches of production, and to enable the agricultural community to equalize the rewards of their labor, and to lessen such burdens as come from unnecessary transportation and undesirable importation.

THE CROP OF 1872.

Corn.—A late, cold spring, and unfavorable weather during the planting season, interfered with the seeding and growth of corn throughout the Western States, and in many portions of the North, and probably

*It is possible that the census of 1870 has been more thorough and systematic than the earlier enumerations, in the return of minor rural occupations, and the "agricultural laborers" of Southern States have been recruited from the ranks of slave laborers. The following statement is from census records:

1870.		1860.	
Agricultural laborers	2, 885, 996	Apiarists	59
Apiarists	136	Dairymen	1, 952
Dairymen and dairywomen	3, 550	Drovers	2, 477
Farm and plantation owners	3, 609	Farmers	2, 423, 895
Farmers and planters	2, 977, 711	Farm-laborers	795, 679
Florists	1, 085	Florists	458
Gardeners and nurserymen	31, 435	Gardeners and nurserymen	21, 323
Stock-drovers	3, 181	Herdsmen	6, 359
Stock-herders	5, 590	Shepherds	1, 153
Stock-raisers	6, 538	Turpentine-makers	1, 353
Turpentine-farmers	361	Vine-dressers	116
Turpentine-laborers	2, 117	Vine-growers	5
Vine-growers	1, 112		
	5, 977, 471		3, 254, 829

diminished its total area, though the estimates show an increase in breadth of three per cent., or more than a million of acres. The early growth of corn in the Ohio Valley was quite uneven, from the variableness in meteorological conditions as referred to in the June report:

In the Ohio Valley, as in Ohio and Indiana, complaints of long and almost unbroken droughts are received from many counties in different parts of those States, affecting wells and streams, and greatly retarding vegetable growth; while in many other counties seasonable and frequent rains are reported, and in some cases abundant supplies of moisture. In other cases wet districts are in close proximity to dry areas; and both wet and dry localities are sometimes found in the same county. In different sections of the country, in which seasons of drought have occurred, sudden and violent storms have deluged low-lying lands, carried away bridges, and damaged crops. These peculiarities are noticeable during each recurring summer, but the variations in amount of rain-fall, and in the frequency and force of storms, seem greater than usual the present summer.

Aside from these inequalities the season was quite favorable in this section, having an unusual measure of sunshine and a degree of heat well suited to the growth of corn. Altogether the season was not very propitious during May and June, and the returns of the 1st of July, showing the condition of corn, placed 413 counties below average, 263 above, and 313 at 100 or average. In Iowa, where cool, cloudy weather generally prevailed in spring, followed by changeable weather, only two reports of superior condition were received; and in Ohio only three were above 100. In the Gulf States, from Alabama to Texas, the rapid growth made in June had placed the crop in average condition. In the West, while amelioration had been marked, the crop had scarcely attained an average of vigor and forwardness. July's showers and sunshine greatly advanced the crop prospect, pushing averages of condition above 100 in nearly all the States, the only exceptions being some of the Atlantic States south of the Potomac, and, in the higher latitudes, Michigan, Wisconsin, Minnesota, and Oregon. Growth in August was continued at an accelerated pace, and it became evident that one of the largest crops ever grown would be harvested. The September report included returns of corn in 917 counties, 530 representing the prospects of the crop above average, 224 average, and only 163 below, or less than one-fifth of the number reported. The estimate of the total product, at the time of gathering, came within a small fraction of 1,100,000,000 bushels, or about equal to the great crop of 1870, and about 25 per cent. more than our original estimate of the crop of 1869, (the one reported by the census of 1870,) which some astute local statisticians confounded with the crop of 1870, thereby assuming a great discrepancy between our estimate and the returns of the census.

Wheat.—Winter-wheat had a slow and halting start. The low temperature of March left forbidding accumulations of snow and ice to chill the views of our April reporters. Over a considerable area snow still covered deeply the grain-fields; in the more southern belt from which snow had disappeared, gloomy forebodings of failure were entertained, and accounts of "freezing out" in spots and patches, the thinning of plants in many fields, and a general lack of vitality, were as frequent as despondent. There were fertile and well-drained, and thoroughly comminuted soils on which a fine growth had commenced upon the departure of winter, of which it was said, "Where the fields were drained, the soil deep and mellow, the casualties of winter have been unknown; where the seeding was done with the drill, on land having any fair degree of suitable preparation, almost absolute immunity from freezing has been secured." There were those, intent upon declaring the crop a failure, who denied the accuracy of this statement and decried the practice of seeding with the drill; but the later history of

the crop verified completely the views expressed, and proved the vast superiority of scientific over slovenly practice in grain-growing.

The injury was greatest in the Middle States, though four-fifths of the counties of Ohio reported an unpromising appearance, and more than two-thirds of those in Indiana, and half of those in Illinois, while the failure in Missouri and Kansas was more complete than elsewhere in the West.

The reports of May and June were entirely in accordance with the expectations formed from the accurate description of the grain-fields in April furnished by our correspondents, and rendered certain a reduction of about one-third in the crop of the Middle States, and a probable decrease of ten to twenty-five per cent. in the several States of the West which grew winter-wheat. In the Southern States the crop, which is always grown on a small area, was unusually promising through the season, and resulted in a comparatively large yield. The crop was remarkably exempt from injury by rust, not only in the southern belt, (a disease to which it is peculiarly liable there,) but in other sections of the country.

There has been less complaint than usual of the depredations of insects. The chinch-bug was troublesome in Illinois, Iowa, and Missouri, and the Hessian fly was reported in several counties in the Ohio Valley.

The spring-wheat crop was a large one in Minnesota, Wisconsin, Iowa, and Nebraska, and the crop of California was heavy in yield upon a large increase in area.

The estimated area sown exceeds 20,000,000 acres, an increase of between one and two per cent. over the breadth of the crop of 1871.

The product of 1872, both spring and winter-wheat, may be deemed an average crop, as it cannot be much less than 250,000,000 bushels, or almost 20,000,000 bushels more than that of 1871, though 37,000,000 bushels less than the census crop of 1869, the largest ever produced in the country.

Hay.—In New England and the Middle States the hay crop was above average, except in New Jersey, where it was 10 per cent., and in Delaware, where it was 45 per cent. below. The fine rains of July and August, in many localities, delayed harvest and caused the crop to be gathered in indifferent condition, but brought up the pastures to an unusually high average. In Delaware, the remarkable shortness of the crop is attributed to severe drought. In Maryland and Virginia the same cause cut down the yield 38 and 31 per cent., respectively, below average. From North Carolina to Florida the crop was above average, but westward to the Mississippi several per cent. below. Louisiana reports 14 per cent. and Texas 4 per cent. above average. In Gonzales County the crop was mostly of millet and mesquite-grass, a branch of production which shows considerable increase. Arkansas is 11 per cent. above average, while Tennessee is 3 per cent. below on account of the drought in some counties shortening timothy and red-top. Kentucky is above average. Ohio and Michigan are, respectively, 18 per cent. and 3 per cent. deficient. All the other Western and Pacific States are above average, the excess ranging from 3 to 14 per cent.

The aggregate of the estimates of quantity is 23,969,800 tons, against 22,239,400 in 1871. The estimated value is $348,000,000, about $3,000,000 less than the estimated value of the previous crop.

Potatoes.—A decrease in the product of potatoes, of about 6 per cent., or 7,000,000 bushels, as compared with that of 1871, is apparent. Rust and rot, resulting from excessive rains, reduced the yield in the northern portion of New England. All the Middle States and the Southern, except North Carolina and Georgia, Florida and Texas, had short crops. Kentucky and Arkansas secured an average crop; and Illinois, Wisconsin, Minnesota, and Iowa had comparatively large crops, the persistent warfare upon the Colorado beetle having reduced the num-

bers of that pest of the potato-patch. The estimate for the entire country is 113,443,000 bushels, grown on 1,317,398 acres, and valued at $68,008,630, which is about $3,000,000 less than the estimate for the crop of 120,460,000 bushels in 1871.

Table showing the product of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop for 1872.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MAINE.					
Indian corn......bushels.	1,218,000	33.5	36,358	$0 94	$1,144,920
Wheat......do....	293,000	16	18,312	1 92	562,560
Rye......do....	30,600	18.1	1,690	1 09	33,354
Oats......do....	1,741,000	29.5	59,016	50	870,500
Barley......do....	526,000	20.6	25,533	83	436,580
Buckwheat......do....	437,000	25.5	17,137	65	284,050
Potatoes......do....	3,655,000	75	48,733	68	2,485,400
Tobacco......pounds.	....	....	....	....	....
Hay......tons.	1,115,000	.92	1,211,956	12 80	14,272,000
Total......	....	....	1,418,735	....	20,089,364
NEW HAMPSHIRE.					
Indian corn......bushels.	1,374,000	38.2	35,968	95	1,305,300
Wheat......do....	182,000	16.5	11,030	1 84	334,880
Rye......do....	43,500	19.5	2,230	1 04	45,240
Oats......do....	1,127,000	33	34,151	59	664,930
Barley......do....	93,000	27.5	3,381	92	85,560
Buckwheat......do....	81,600	19	4,294	57	46,512
Potatoes......do....	3,099,000	94	32,968	87	2,696,130
Tobacco......pounds.	675,000	1,500	450	27.5	185,625
Hay......tons.	658,000	1.02	645,098	14 66	9,646,280
Total......	....	....	769,570	....	15,010,457
VERMONT.					
Indian corn......bushels.	1,921,000	39	49,256	84	1,613,640
Wheat......do....	392,000	16	24,500	1 74	682,080
Rye......do....	62,100	17.7	3,508	1 13	70,173
Oats......do....	3,509,000	35.2	99,687	48	1,684,320
Barley......do....	100,000	22	4,545	86	86,000
Buckwheat......do....	315,000	20	15,750	64	201,600
Potatoes......do....	4,171,000	107	38,981	53	2,210,630
Tobacco......pounds.	500,000	1,450	344	25	125,000
Hay......tons.	1,015,000	1.16	875,000	13 00	13,195,000
Total......	....	....	1,111,571	....	19,868,443
MASSACHUSETTS.					
Indian corn......bushels.	1,461,000	34	42,970	90	1,314,900
Wheat......do....	32,000	17.4	1,839	1 95	62,400
Rye......do....	235,000	17.5	13,428	1 03	242,050
Oats......do....	716,000	30.4	23,552	61	436,760
Barley......do....	118,000	23.2	5,086	76	89,680
Buckwheat......do....	47,000	14.2	3,309	90	42,300
Potatoes......do....	2,185,000	102	21,421	88	1,922,800
Tobacco......pounds.	8,438,000	1,750	4,821	29.5	2,489,210
Hay......tons.	465,000	1.12	415,178	21 37	9,937,050
Total......	....	....	531,604	....	16,537,150
RHODE ISLAND.					
Indian corn......bushels.	295,000	30	9,833	90	265,500
Wheat......do....	....	....	....	....	....
Rye......do....	19,300	16.3	1,184	98	18,914
Oats......do....	163,000	35.6	4,578	50	81,500
Barley......do....	29,300	23	1,273	90	26,370
Buckwheat......do....	....	....	....	....	....
Potatoes......do....	484,000	90	5,377	90	435,600
Tobacco......pounds.	....	....	....	....	....
Hay......tons.	85,000	1.02	83,333	32 50	2,762,500
Total......	....	....	105,578	....	3,590,384

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
CONNECTICUT.					
Indian corn……bushels.	1,705,000	31.2	54,647	$0 92	$1,568,600
Wheat……do….	37,100	17	2,182	1 65	61,215
Rye……do….	311,000	15.8	19,683	1 10	342,100
Oats……do….	1,063,000	35.8	29,692	61	648,430
Barley……do….	23,000	23.1	995	90	20,700
Buckwheat……do….	94,900	19.2	4,942	96	91,104
Potatoes……do….	1,819,000	100	18,190	82	1,491,580
Tobacco……pounds.	8,336,000	1,650	5,052	30	2,500,800
Hay……tons.	534,000	1.13	472,566	26 05	13,910,700
Total……	……	……	607,949	……	20,635,229
NEW YORK.					
Indian corn……bushels.	19,231,000	37.5	512,826	70	13,461,700
Wheat……do….	6,712,000	12.5	536,960	1 65	11,074,800
Rye……do….	1,872,000	13.5	138,666	89	1,666,080
Oats……do….	31,305,000	35	894,428	44	13,774,200
Barley……do….	6,529,000	23.5	277,829	81	5,288,490
Buckwheat……do….	2,781,000	18.5	150,324	83	2,308,230
Potatoes……do….	23,739,000	88	269,761	63	14,955,570
Tobacco……pounds.	3,000,000	1,033	2,904	09	270,000
Hay……tons.	4,516,000	1.25	3,612,800	18 60	83,997,600
Total……	……	……	6,396,498	……	146,796,670
NEW JERSEY.					
Indian corn……bushels.	12,142,000	39.5	307,392	62	7,528,040
Wheat……do….	1,680,000	13.5	124,444	1 73	2,906,400
Rye……do….	454,000	13	34,923	88	399,520
Oats……do….	3,076,000	27.4	112,262	48	1,476,480
Barley……do….	6,500	23.5	276	92	5,980
Buckwheat……do….	277,000	15.5	17,870	1 00	277,000
Potatoes……do….	2,951,000	75	39,346	87	2,567,370
Tobacco……pounds.	……	……	……	……	……
Hay……tons.	362,000	1.15	314,782	31 60	11,439,200
Total……	……	……	951,295	……	26,590,990
PENNSYLVANIA.					
Indian corn……bushels.	43,964,000	39	1,127,282	60	26,378,400
Wheat……do….	11,603,000	10.8	1,074,351	1 67	19,377,010
Rye……do….	3,069,000	13.4	229,029	86	2,639,340
Oats……do….	31,545,000	31.2	1,011,057	43	13,564,350
Barley……do….	453,000	18.4	24,619	88	398,640
Buckwheat……do….	2,152,000	20	107,600	93	2,001,360
Potatoes……do….	11,161,000	99	112,737	63	7,031,430
Tobacco……pounds.	14,750,000	1,300	11,346	14.6	2,153,500
Hay……tons.	2,091,000	.98	2,133,673	22 84	47,758,440
Total……	……	……	5,831,694	……	121,302,470
DELAWARE.					
Indian corn……bushels.	3,289,000	20	164,450	55	1,808,950
Wheat……do….	550,000	9.2	59,782	1 60	880,000
Rye……do….	10,700	7.5	1,426	82	8,774
Oats……do….	318,000	15.5	20,516	42	133,560
Barley……do….	1,700	15.4	110	85	1,445
Buckwheat……do….	1,100	20	55	90	990
Potatoes……do….	178,000	75	2,373	1 00	178,000
Tobacco……pounds.	……	……	……	……	……
Hay……tons.	21,000	.80	26,250	30 00	630,000
Total……	……	……	274,962	……	3,641,719

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MARYLAND.					
Indian corn......bushels.	11, 002, 000	23	478, 347	$0 57	$6, 271, 140
Wheat......do....	3, 957, 000	8. 5	465, 529	1 68	6, 647, 760
Rye......do....	287, 000	11. 6	24, 741	79	226, 730
Oats......do....	1, 999, 000	14. 3	139, 790	40	799, 600
Barley......do....	9, 300	15	620	78	7, 254
Buckwheat......do....	52, 500	15	3, 500	80	42, 000
Potatoes......do....	1, 028, 000	53	19, 396	88	904, 640
Tobacco......pounds.	13, 330, 000	600	22, 216	10	1, 333, 000
Hay......tons.	121, 000	. 70	172, 857	32 87	3, 977, 270
Total......	......	......	1, 326, 996	......	20, 209, 394
VIRGINIA.					
Indian corn......bushels.	18, 184, 000	21	865, 904	58	10, 546, 720
Wheat......do....	6, 432, 000	8. 4	765, 714	1 56	10, 033, 920
Rye......do....	443, 000	13. 5	32, 814	72	318, 960
Oats......do....	4, 089, 000	13	314, 538	46	1, 880, 940
Barley......do....	6, 600	17. 5	377	75	4, 950
Buckwheat......do....	32, 000	14. 2	2, 253	62	19, 840
Potatoes......do....	1, 080, 000	67	16, 119	72	777, 600
Tobacco......pounds.	48, 000, 000	750	64, 000	10. 4	4, 992, 000
Hay......tons.	128, 000	. 86	148, 837	21 25	2, 720, 000
Total......	......	......	2, 210, 556	......	31, 294, 930
NORTH CAROLINA.					
Indian corn......bushels.	24, 012, 000	16	1, 500, 750	62	14, 887, 440
Wheat......do....	3, 289, 000	8. 2	401, 097	1 53	5, 032, 170
Rye......do....	342, 000	7. 4	46, 216	93	318, 060
Oats......do....	2, 860, 000	13. 8	207, 246	80	2, 288, 000
Barley......do....	2, 300	15. 5	148	78	1, 794
Buckwheat......do....	19, 500	11. 8	1, 652	69	13, 455
Potatoes......do....	848, 000	103	8, 233	70	593, 600
Tobacco......pounds.	13, 200, 000	666	19, 819	10	1, 320, 000
Hay......tons.	90, 000	1. 20	75, 000	14 15	1, 273, 500
Total......	......	......	2, 260, 161	......	25, 728, 019
SOUTH CAROLINA.					
Indian corn......bushels.	10, 627, 000	10. 5	1, 012, 095	96	10, 201, 920
Wheat......do....	662, 000	6. 1	108, 524	1 88	1, 244, 560
Rye......do....	50, 000	7. 5	6, 666	1 48	74, 000
Oats......do....	494, 000	8	61, 750	80	395, 200
Barley......do....	5, 100	15. 5	329	80	4, 080
Buckwheat......do....	......	......	......	......	......
Potatoes......do....	73, 000	80	912	1 00	73, 000
Tobacco......pounds.	50, 000	600	83	12	6, 000
Hay......tons.	17, 300	1	17, 300	36 00	622, 800
Total......	......	......	1, 207, 659	......	12, 621, 560
GEORGIA.					
Indian corn......bushels.	23, 777, 000	12. 5	1, 902, 160	86	20, 448, 220
Wheat......do....	3, 109, 000	9	345, 444	1 73	5, 378, 570
Rye......do....	108, 000	10. 2	10, 588	1 56	168, 480
Oats......do....	1, 814, 000	12. 5	145, 120	83	1, 505, 620
Barley......do....	5, 100	13. 5	377	95	4, 845
Buckwheat......do....	......	......	......	......	......
Potatoes......do....	202, 000	92	2, 195	1 27	256, 540
Tobacco......pounds.	350, 000	500	700	17. 8	62, 300
Hay......tons.	17, 600	1. 47	11, 972	25 31	445, 456
Total......	......	......	2, 418, 556	......	28, 270, 031

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
FLORIDA.					
Indian corn......bushels.	1,920,000	9.6	200,000	$1 20	$2,304,000
Wheat......do....					
Rye......do....					
Oats......do....	104,000	11.2	9,285	93	96,720
Barley......do....					
Buckwheat......do....					
Potatoes......do....					
Tobacco......pounds.					
Hay......tons.					
Total......			209,285		2,400,720
ALABAMA.					
Indian corn......bushels.	22,896,000	17.6	1,300,909	78	17,858,880
Wheat......do....	1,106,000	9.5	116,421	1 48	1,636,880
Rye......do....	22,000	11	2,000	1 28	28,160
Oats......do....	651,000	12.6	51,666	82	533,820
Barley......do....					
Buckwheat......do....					
Potatoes......do....	147,000	76	1,934	1 15	169,050
Tobacco......pounds.					
Hay......tons.	13,900	1	13,900	18 33	254,787
Total......			1,486,830		20,481,577
MISSISSIPPI.					
Indian corn......bushels.	21,816,000	17.5	1,246,628	88	19,198,080
Wheat......do....	199,000	10.3	19,320	1 57	312,430
Rye......do....	16,000	9	1,777	1 75	28,000
Oats......do....	460,000	12.5	36,800	1 06	487,600
Barley......do....					
Buckwheat......do....					
Potatoes......do....	209,000	85	2,458	1 16	242,440
Tobacco......pounds.					
Hay......tons.	12,400	1.25	9,920	24 14	299,336
Total......			1,316,903		20,567,886
LOUISIANA.					
Indian corn......bushels.	10,125,000	18.5	547,297	88	8,910,000
Wheat......do....					
Rye......do....					
Oats......do....	40,000	19.1	2,094	1 32	52,800
Barley......do....					
Buckwheat......do....					
Potatoes......do....	62,000	55	1,127	87	53,940
Tobacco......pounds.					
Hay......tons.	12,900	1.12	11,517	23 33	300,957
Total......			562,035		9,317,697
TEXAS.					
Indian corn......bushels.	27,934,000	25.3	1,104,110	43	12,011,620
Wheat......do....	1,377,000	18.5	74,432	1 65	2,272,050
Rye......do....	54,000	17.2	3,139	1 38	74,520
Oats......do....	783,000	25.4	30,826	81	634,230
Barley......do....	51,000	25	2,040	1 00	51,000
Buckwheat......do....					
Potatoes......do....	270,000	110	2,454	1 89	510,300
Tobacco......pounds.					
Hay......tons.	34,400	1.13	30,442	13 52	465,088
Total......			1,247,443		16,018,808

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
ARKANSAS.					
Indian corn....bushels.	17, 062, 000	23. 5	726, 042	$0 73	$12, 455, 260
Wheat....do....	701, 000	10. 4	67, 403	1 52	1, 065, 520
Rye....do....	39, 000	12. 5	3, 120	1 50	58, 500
Oats....do....	702, 000	24. 5	28, 653	64	449, 280
Barley....do....	....	....	....	....	....
Buckwheat....do....	....	....	....	....	....
Potatoes....do....	397, 000	78	5, 089	1 02	404, 940
Tobacco....pounds.	875, 000	950	921	16. 6	145, 250
Hay....tons.	12, 400	1. 15	10, 782	20 00	248, 000
Total....	....	....	842, 010	....	14, 826, 750
TENNESSEE.					
Indian corn....bushels.	46, 818, 000	23. 5	1, 992, 255	48	22, 472, 640
Wheat....do....	10, 298, 000	9. 6	1, 072, 708	1 40	14, 417, 200
Rye....do....	222, 000	9. 2	24, 130	88	195, 360
Oats....do....	5, 103, 000	18. 7	272, 887	42	2, 143, 260
Barley....do....	81, 000	18. 5	4, 378	78	63, 180
Buckwheat....do....	62, 000	7. 6	8, 266	95	58, 900
Potatoes....do....	1, 122, 000	77	14, 571	57	639, 540
Tobacco....pounds.	25, 000, 000	748	33, 422	11. 7	2, 925, 000
Hay....tons.	117, 000	1. 21	96, 694	15. 46	1, 808, 820
Total....	....	....	3, 519, 311	....	44, 723, 900
WEST VIRGINIA.					
Indian corn....bushels.	9, 905, 000	28. 5	347, 543	55	5, 447, 750
Wheat....do....	2, 712, 000	10. 3	263, 300	1 43	3, 878, 160
Rye....do....	278, 000	13. 5	20, 592	88	244, 640
Oats....do....	2, 341, 000	24. 1	97, 136	38	889, 580
Barley....do....	53, 500	11. 5	4, 652	95	50, 825
Buckwheat....do....	61, 000	13. 4	4, 552	88	53, 680
Potatoes....do....	833, 000	65	12, 815	60	499, 800
Tobacco....pounds.	2, 300, 000	575	4, 000	10. 9	250, 700
Hay....tons.	173, 000	. 92	188, 043	16 57	2, 866, 610
Total....	....	....	942, 633	....	14, 181, 745
KENTUCKY.					
Indian corn....bushels.	63, 534, 000	31. 2	2, 036, 346	37	23, 507, 580
Wheat....do....	7, 854, 000	12	654, 500	1 29	10, 131, 660
Rye....do....	1, 303, 000	15. 1	86, 291	73	951, 190
Oats....do....	6, 767, 000	24. 6	275, 081	49	3, 315, 830
Barley....do....	243, 000	22	11, 045	73	177, 390
Buckwheat....do....	3, 800	15. 2	250	1 00	3, 800
Potatoes....do....	2, 145, 000	70	30, 642	58	1, 244, 100
Tobacco....pounds.	130, 000, 000	775	167, 741	08. 4	10, 920, 000
Hay....tons.	352, 000	1. 32	266, 666	13 09	4, 607, 680
Total....	....	....	3, 528, 562	....	54, 859, 230
OHIO.					
Indian corn....bushels.	99, 351, 000	39. 5	2, 515, 215	34	33, 779, 340
Wheat....do....	18, 203, 000	11. 7	1, 555, 811	1 42	25, 848, 260
Rye....do....	414, 000	11. 2	36, 964	73	302, 220
Oats....do....	27, 489, 000	30	916, 300	29	7, 971, 810
Barley....do....	1, 752, 000	23. 2	75, 517	71	1, 243, 920
Buckwheat....do....	218, 000	13	16, 769	94	204, 920
Potatoes....do....	7, 751, 000	80	96, 887	63	4, 883, 130
Tobacco....pounds	30, 000, 000	1, 050	28, 571	08. 1	2, 430, 000
Hay....do....	1, 730, 000	1	1, 730, 000	14 43	24, 963, 900
Total....	....	....	6, 972, 034	....	101, 627, 500

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MICHIGAN.					
Indian corn.......bushels.	16,987,000	36	471,861	$0 43	$7,304,410
Wheat.......do....	13,936,000	12	1,161,333	1 46	20,346,560
Rye.......do....	228,000	14	16,285	74	168,720
Oats.......do....	9,248,000	30	308,266	32	2,959,360
Barley.......do....	554,000	23.6	23,474	81	448,740
Buckwheat.......do....	425,000	15.8	26,898	76	323,000
Potatoes.......do....	6,009,000	66	91,045	63	3,785,670
Tobacco.......pounds.	....	....	....	....	....
Hay.......tons.	1,050,000	1.07	981,308	12 26	12,873,000
Total.......	....	....	3,080,470	....	48,209,460
INDIANA.					
Indian corn.......bushels.	85,541,000	38.7	2,210,361	29	24,806,890
Wheat.......do....	19,381,000	12.4	1,562,983	1 32	25,582,920
Rye.......do....	410,000	14.5	28,275	65	266,500
Oats.......do....	13,080,000	30.5	428,852	25	3,270,000
Barley.......do....	323,000	24	13,458	69	222,870
Buckwheat.......do....	166,000	14.6	11,448	85	141,100
Potatoes.......do....	2,801,000	70	40,014	54	1,512,540
Tobacco.......pounds.	16,250,000	716	22,695	07	1,137,500
Hay.......tons.	859,000	1.24	692,741	12 53	10,763,270
Total.......	....	....	5,010,827	....	67,703,590
ILLINOIS.					
Indian corn.......bushels.	217,628,000	39.8	5,468,040	24	52,230,720
Wheat.......do....	24,711,000	12.1	2,042,231	1 23	30,394,530
Rye.......do....	2,211,000	18.1	122,154	50	1,105,500
Oats.......do....	43,122,000	36.6	1,178,196	19	8,193,180
Barley.......do....	2,073,000	26.1	79,425	55	1,140,150
Buckwheat.......do....	159,000	15	10,600	81	128,790
Potatoes.......do....	9,668,000	75	128,906	46	4,447,280
Tobacco.......pounds.	7,500,000	850	8,823	08.5	637,500
Hay.......tons.	1,929,000	1.35	1,428,888	9 47	18,267,630
Total.......	....	....	10,467,263	....	116,545,280
WISCONSIN.					
Indian corn.......bushels.	21,180,000	38	557,368	40	8,472,000
Wheat.......do....	22,307,000	14.3	1,559,930	1 03	22,976,210
Rye.......do....	1,193,000	16.8	71,011	57	680,010
Oats.......do....	16,546,000	35.5	466,084	32	5,294,720
Barley.......do....	1,546,000	28.6	54,055	57	881,220
Buckwheat.......do....	439,000	17.5	25,085	60	263,400
Potatoes.......do....	5,226,000	97	53,876	44	2,299,440
Tobacco.......pounds.	3,250,000	1,025	3,170	08.6	279,500
Hay.......tons.	1,398,000	1.33	1,051,127	9 82	13,728,360
Total.......	....	....	3,841,706	....	54,874,860
MINNESOTA.					
Indian corn.......bushels.	7,988,000	35.2	226,931	36	2,875,680
Wheat.......do....	23,200,000	16.5	1,406,060	83	19,256,000
Rye.......do....	75,000	17.7	4,237	49	36,750
Oats.......do....	9,459,000	36.5	259,150	26	2,459,340
Barley.......do....	979,000	26.7	36,666	42	411,180
Buckwheat.......do....	46,000	18.7	2,459	90	41,400
Potatoes.......do....	2,216,000	99	22,383	26	576,160
Tobacco.......pounds.	....	....	....	....	....
Hay.......tons.	803,000	1.35	594,814	5 67	4,553,010
Total.......	....	....	2,552,700	....	30,209,520

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
IOWA.					
Indian corn.........bushels.	101, 989, 000	39. 8	2, 562, 537	$0 18	$18, 358, 020
Wheat.........do....	22, 080, 000	12. 6	1, 752, 380	85	18, 768, 000
Rye.........do....	533, 000	19. 5	27, 333	47	250, 510
Oats.........do....	19, 934, 000	36. 7	543, 160	16	3, 189, 440
Barley.........do....	2, 194, 000	27. 9	78, 637	42	921, 480
Buckwheat.........do....	162, 000	20. 1	8, 059	69	111, 780
Potatoes.........do....	6, 631, 000	120	55, 258	22	1, 458, 820
Tobacco.........pounds.	....	....	....	....	....
Hay.........tons.	1, 664, 000	1. 35	1, 232, 592	6 07	10, 100, 480
Total.........	....	....	6, 259, 956	....	53, 158, 530
MISSOURI.					
Indian corn.........bushels.	105, 741, 000	37	2, 857, 864	32	33, 837, 120
Wheat.........do....	7, 695, 000	8. 8	874, 431	1 41	10, 849, 950
Rye.........do....	406, 000	16	25, 375	71	288, 260
Oats.........do....	16, 850, 000	32. 7	515, 290	23	3, 875, 500
Barley.........do....	251, 000	23	10, 913	73	183, 230
Buckwheat.........do....	43, 000	18. 9	2, 275	76	32, 680
Potatoes.........do....	3, 171, 000	80	39, 637	50	1, 585, 500
Tobacco.........pounds.	16, 500, 000	1, 069	15, 434	09. 5	1, 567, 500
Hay.........tons.	601, 000	1. 20	500, 833	9 73	5, 847, 730
Total.........	....	....	4, 842, 052	....	58, 067, 470
KANSAS.					
Indian corn.........bushels.	29, 631, 000	38. 5	769, 636	22	6, 518, 820
Wheat.........do....	2, 155, 000	11. 6	185, 775	1 42	3, 060, 100
Rye.........do....	81, 000	17. 5	4, 628	71	57, 510
Oats.........do....	6, 084, 000	32. 5	187, 200	22	1, 338, 480
Barley.........do....	111, 000	22. 5	4, 933	60	66, 600
Buckwheat.........do....	34, 000	17. 2	1, 976	90	30, 600
Potatoes.........do....	3, 797, 000	90	42, 188	42	1, 594, 740
Tobacco.........pounds.	....	....	....	....	....
Hay.........tons.	728, 000	1. 35	539, 259	3 89	2, 831, 920
Total.........	....	....	1, 735, 595	....	15, 498, 770
NEBRASKA.					
Indian corn.........bushels.	7, 589, 000	37. 8	200, 767	18	1, 366, 020
Wheat.........do....	2, 560, 000	12. 2	209, 836	78	1, 996, 800
Rye.........do....	12, 300	15. 5	793	40	4, 920
Oats.........do....	1, 667, 000	37. 5	44, 453	16	266, 720
Barley.........do....	309, 000	25. 5	12, 117	39	120, 510
Buckwheat.........do....	3, 500	18. 5	189	71	2, 485
Potatoes.........do....	958, 000	110	8, 709	28	268, 240
Tobacco.........pounds.	....	....	....	....	....
Hay.........tons.	189, 000	1. 40	135, 000	3 81	720, 090
Total.........	....	....	611, 864	....	4, 745, 785
CALIFORNIA.					
Indian corn.........bushels.	1, 400, 000	35	40, 000	1 00	1, 400, 000
Wheat.........do....	25, 600, 000	12. 2	2, 098, 360	1 11	28, 416, 000
Rye.........do....	36, 000	12	3, 000	1 02	36, 720
Oats.........do....	2, 250, 000	25	90, 000	74	1, 665, 000
Barley.........do....	7, 359, 000	12. 2	603, 196	85	6, 255, 150
Buckwheat.........do....	19, 800	21	942	1 11	21, 978
Potatoes.........do....	1, 900, 000	59	32, 203	1 13	2, 147, 000
Tobacco.........pounds.	....	....	....	....	....
Hay.........tons.	620, 000	1. 50	413, 333	15 60	9, 672, 000
Total.........	....	....	3, 281, 034	....	49, 613, 848

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1872.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
OREGON.					
Indian corn....bushels.	89,000	28	3,178	$0 93	$82,770
Wheat....do....	2,406,000	18.2	132,197	74	1,780,440
Rye....do....	3,800	23.2	163	73	2,774
Oats....do....	1,790,000	28.2	63,475	51	912,900
Barley....do....	243,000	24.6	9,878	60	145,800
Buckwheat....do....	800	18.6	43	83	664
Potatoes....do....	482,000	102	4,725	55	265,100
Tobacco....pounds.	....	....	....	....	....
Hay....tons.	77,900	1.35	57,703	17 25	1,343,775
Total....	....	....	271,362	....	4,534,223
NEVADA.					
Indian corn....bushels.	13,000	33	393	1 50	19,500
Wheat....do....	314,000	25	12,560	1 75	549,500
Rye....do....	....	....	....	....	....
Oats....do....	73,000	35	2,085	1 00	73,000
Barley....do....	402,000	30	13,400	1 50	603,000
Buckwheat....do....	....	....	....	....	....
Potatoes....do....	173,000	140	1,235	2 00	346,000
Tobacco....pounds.	....	....	....	....	....
Hay....tons.	52,000	1.75	29,714	20 00	1,040,000
Total....	....	....	59,387	....	2,631,000
THE TERRITORIES.					
Indian corn....bushels.	1,380,000	33.4	41,317	86	1,186,800
Wheat....do....	2,272,000	23.5	96,680	1 04	2,362,880
Rye....do....	14,300	24	595	78	11,154
Oats....do....	1,385,000	38	36,447	75	1,038,750
Barley....do....	414,000	30	13,800	94	389,160
Buckwheat....do....	....	....	....	....	....
Potatoes....do....	875,000	136	6,433	66	577,500
Tobacco....pounds.	....	....	....	....	....
Hay....tons.	148,000	1.70	87,058	12 33	1,824,840
Total....	....	....	282,330	....	7,391,084

Summary for each State, showing the product, the number of acres, and the value of each crop for 1872.

States	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1, 218, 000	36, 358	$1, 144, 920	293, 000	18, 312	$562, 560	30, 600	1, 690	$33, 354
New Hampshire	1, 374, 000	35, 968	1, 305, 300	182, 000	11, 030	334, 880	43, 500	2, 230	45, 240
Vermont	1, 921, 000	49, 256	1, 613, 640	392, 000	24, 500	682, 080	62, 100	3, 508	70, 173
Massachusetts	1, 461, 000	42, 970	1, 314, 900	32, 000	1, 839	62, 400	235, 000	13, 428	242, 050
Rhode Island	295, 000	9, 833	265, 500	....	....	....	19, 300	1, 184	18, 914
Connecticut	1, 705, 000	54, 647	1, 568, 600	37, 100	2, 182	61, 215	311, 000	19, 683	342, 1[illegible]
New York	19, 231, 000	512, 826	13, 461, 700	6, 712, 000	536, 960	11, 074, 800	1, 872, 000	138, 666	1, 666, 080
New Jersey	12, 142, 000	307, 392	7, 528, 040	1, 680, 000	124, 444	2, 906, 400	454, 000	34, 923	399, 520
Pennsylvania	43, 964, 000	1, 127, 282	26, 378, 400	11, 603, 000	1, 074, 351	19, 377, 010	3, 069, 000	229, 029	2, 639, 340
Delaware	3, 289, 000	164, 450	1, 808, 950	550, 000	59, 782	880, 000	10, 700	1, 426	8, 774
Maryland	11, 002, 000	478, 347	6, 271, 140	3, 957, 000	465, 529	6, 647, 760	287, 000	24, 741	226, 730
Virginia	18, 184, 000	865, 904	10, 546, 720	6, 432, 000	765, 714	10, 033, 920	443, 000	32, 814	318, 960
North Carolina	24, 012, 000	1, 500, 750	14, 887, 440	3, 289, 000	401, 097	5, 032, 170	342, 000	46, 216	318, 060
South Carolina	10, 627, 000	1, 012, 095	10, 201, 920	662, 000	108, 524	1, 244, 560	50, 000	6, 666	74, 000
Georgia	23, 777, 000	1, 902, 160	20, 448, 220	3, 109, 000	345, 444	5, 378, 570	108, 000	10, 588	168, 480
Florida	1, 920, 000	200, 000	2, 304, 000	....	....	....	....	....	....
Alabama	22, 896, 000	1, 300, 909	17, 858, 880	1, 106, 000	116, 421	1, 636, 880	22, 000	2, 000	28, 160
Mississippi	21, 816, 000	1, 246, 628	19, 198, 080	199, 000	19, 320	312, 430	16, 000	1, 777	28, 000
Louisiana	10, 125, 000	547, 297	8, 910, 000	....	....	....	....	....	....
Texas	27, 934, 000	1, 104, 110	12, 011, 620	1, 377, 000	74, 432	2, 272, 050	54, 000	3, 139	74, 520
Arkansas	17, 062, 000	726, 042	12, 455, 260	701, 000	67, 403	1, 065, 520	39, 000	3, 120	58, 500
Tennessee	46, 818, 000	1, 992, 255	22, 472, 640	10, 298, 000	1, 072, 708	14, 417, 200	222, 000	24, 130	195, 360
West Virginia	9, 905, 000	347, 543	5, 447, 750	2, 712, 000	263, 300	3, 878, 160	278, 000	20, 592	244, 640
Kentucky	63, 534, 000	2, 036, 346	23, 507, 580	7, 854, 000	654, 500	10, 131, 660	1, 303, 000	86, 291	951, 190
Ohio	99, 351, 000	2, 515, 215	33, 779, 340	18, 203, 000	1, 555, 811	25, 848, 260	414, 000	36, 964	302, 220
Michigan	16, 987, 000	471, 861	7, 304, 410	13, 936, 000	1, 161, 333	20, 346, 560	228, 000	16, 285	168, 720
Indiana	85, 541, 000	2, 210, 361	24, 806, 890	19, 381, 000	1, 562, 983	25, 582, 920	410, 000	28, 275	266, 500
Illinois	217, 628, 000	5, 468, 040	52, 230, 720	24, 711, 000	2, 042, 231	30, 394, 530	2, 211, 000	122, 154	1, 105, 500
Wisconsin	21, 180, 000	557, 368	8, 472, 000	22, 307, 000	1, 559, 930	22, 976, 210	1, 193, 000	71, 011	680, 010
Minnesota	7, 988, 000	226, 931	2, 875, 680	23, 200, 000	1, 406, 060	19, 256, 000	75, 000	4, 237	36, 750
Iowa	101, 989, 000	2, 562, 537	18, 358, 020	22, 080, 000	1, 752, 380	18, 768, 000	533, 000	27, 333	250, 510
Missouri	105, 741, 000	2, 857, 864	33, 837, 120	7, 695, 000	874, 431	10, 849, 950	406, 000	25, 375	288, 260
Kansas	29, 631, 000	769, 636	6, 518, 820	2, 155, 000	185, 775	3, 060, 100	81, 000	4, 628	57, 510
Nebraska	7, 589, 000	200, 767	1, 366, 020	2, 560, 000	209, 836	1, 996, 800	12, 300	793	4, 920
California	1, 400, 000	40, 000	1, 400, 000	25, 600, 000	2, 098, 360	28, 416, 000	36, 000	3, 000	36, 720
Oregon	89, 000	3, 178	82, 770	2, 406, 000	132, 197	1, 780, 440	3, 800	163	2, 774
Nevada	13, 000	393	19, 500	314, 000	12, 560	549, 500	....	....	....
The Territories	1, 380, 000	41, 317	1, 186, 800	2, 272, 000	96, 680	2, 362, 880	14, 300	595	11, 154
Total	1, 092, 719, 000	35, 526, 836	435, 149, 290	249, 997, 100	20, 858, 359	310, 180, 375	14, 888, 600	1, 048, 654	11, 363, 693

Summary for each State, showing the product, the number of acres, and the value of each crop for 1872—Continued.

States.	OATS.			BARLEY.			BUCKWHEAT.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1, 741, 000	59, 016	$870, 500	526, 000	25, 533	$436, 580	437, 000	17, 137	$284, 050
New Hampshire	1, 127, 000	34, 151	664, 930	93, 000	3, 381	85, 560	81, 600	4, 294	46, 512
Vermont	3, 509, 000	99, 687	1, 684, 320	100, 000	4, 545	86, 000	315, 000	15, 750	201, 600
Massachusetts	716, 000	23, 552	436, 760	118, 000	5, 086	89, 680	47, 000	3, 309	42, 300
Rhode Island	163, 000	4, 578	81, 500	29, 300	1, 273	26, 370			
Connecticut	1, 063, 000	29, 692	648, 430	23, 000	995	20, 700	94, 900	4, 942	91, 104
New York	31, 305, 000	894, 428	13, 774, 200	6, 529, 000	277, 829	5, 288, 490	2, 781, 000	150, 324	2, 308, 230
New Jersey	3, 076, 000	112, 262	1, 476, 480	6, 500	276	5, 980	277, 000	17, 870	277, 000
Pennsylvania	31, 545, 000	1, 011, 057	13, 564, 350	453, 000	24, 619	398, 640	2, 152, 000	107, 600	2, 001, 360
Delaware	318, 000	20, 516	133, 560	1, 700	110	1, 445	1, 100	55	990
Maryland	1, 999, 000	139, 790	799, 600	9, 300	620	7, 254	52, 500	3, 500	42, 000
Virginia	4, 089, 000	314, 538	1, 880, 940	6, 600	377	4, 950	32, 000	2, 253	19, 840
North Carolina	2, 860, 000	207, 246	2, 288, 000	2, 300	148	1, 794	19, 500	1, 652	13, 455
South Carolina	494, 000	61, 750	395, 200	5, 100	329	4, 080			
Georgia	1, 814, 000	145, 120	1, 505, 620	5, 100	377	4, 845			
Florida	104, 000	9, 285	96, 720						
Alabama	651, 000	51, 666	533, 820						
Mississippi	460, 000	36, 800	487, 600						
Louisiana	40, 000	2, 094	52, 800						
Texas	783, 000	30, 826	634, 230	51, 000	2, 040	51, 000			
Arkansas	702, 000	28, 653	449, 280						
Tennessee	5, 103, 000	272, 887	2, 143, 260	81, 000	4, 378	63, 180	62, 000	8, 266	58, 900
West Virginia	2, 341, 000	97, 136	889, 580	53, 500	4, 652	50, 825	61, 000	4, 552	53, 680
Kentucky	6, 767, 000	275, 081	3, 315, 830	243, 000	11, 045	177, 390	3, 800	250	3, 800
Ohio	27, 489, 000	916, 300	7, 971, 810	1, 752, 000	75, 517	1, 243, 920	218, 000	16, 769	204, 920
Michigan	9, 248, 000	308, 266	2, 959, 360	554, 000	23, 474	448, 740	425, 000	26, 898	323, 000
Indiana	13, 080, 000	428, 852	3, 270, 000	323, 000	13, 458	222, 870	166, 000	11, 448	141, 100
Illinois	43, 122, 000	1, 178, 196	8, 193, 180	2, 073, 000	79, 425	1, 140, 150	159, 000	10, 600	128, 790
Wisconsin	16, 546, 000	466, 084	5, 294, 720	1, 546, 000	54, 055	881, 220	439, 000	25, 085	263, 400
Minnesota	9, 459, 000	259, 150	2, 459, 340	979, 000	36, 666	411, 180	46, 000	2, 459	41, 400
Iowa	19, 934, 000	543, 160	3, 189, 440	2, 194, 000	78, 637	921, 480	162, 000	8, 059	111, 780
Missouri	16, 850, 000	515, 290	3, 875, 500	251, 000	10, 913	183, 230	43, 000	2, 275	32, 680
Kansas	6, 084, 000	187, 200	1, 338, 480	111, 000	4, 933	66, 600	34, 000	1, 976	30, 600
Nebraska	1, 667, 000	44, 453	266, 720	309, 000	12, 117	120, 510	3, 500	189	2, 485
California	2, 250, 000	90, 000	1, 665, 000	7, 359, 000	603, 196	6, 255, 150	19, 800	942	21, 978
Oregon	1, 790, 000	63, 475	912, 900	243, 000	9, 878	145, 800	800	43	664
Nevada	73, 000	2, 085	73, 000	402, 000	13, 400	603, 000			
The Territories	1, 385, 000	36, 447	1, 038, 750	414, 000	13, 800	389, 160			
Total	271, 747, 000	9, 000, 769	91, 315, 710	26, 846, 400	1, 397, 082	19, 837, 773	8, 133, 500	448, 497	6, 747, 618

Summary for each State, showing the product, the number of acres, and the value of each crop for 1872—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value of crop.	Pounds.	Acres.	Value of crop.	Tons.	Acres.	Value of crop.
Maine	3, 655, 000	48, 733	$2, 485, 400				1, 115, 000	1, 211, 956	$14, 272, 000
New Hampshire	3, 099, 000	32, 968	2, 696, 130	675, 000	450	$185, 625	658, 000	645, 098	9, 646, 280
Vermont	4, 171, 000	38, 981	2, 210, 630	500, 000	344	125, 000	1, 015, 000	875, 000	13, 195, 000
Massachusetts	2, 185, 000	21, 421	1, 922, 800	8, 438, 000	4, 821	2, 489, 210	465, 000	415, 178	9, 937, 050
Rhode Island	484, 000	5, 377	435, 600				85, 000	83, 333	2, 762, 500
Connecticut	1, 819, 000	18, 190	1, 491, 580	8, 336, 000	5, 052	2, 500, 800	534, 000	472, 566	13, 910, 700
New York	23, 739, 000	269, 761	14, 955, 570	3, 000, 000	2, 904	270, 000	4, 516, 000	3, 612, 800	83, 997, 600
New Jersey	2, 951, 000	39, 346	2, 567, 370				362, 000	314, 782	11, 439, 200
Pennsylvania	11, 161, 000	112, 737	7, 031, 430	14, 750, 000	11, 346	2, 153, 500	2, 091, 000	2, 133, 673	47, 758, 440
Delaware	178, 000	2, 373	178, 000				21, 000	26, 250	630, 000
Maryland	1, 028, 000	19, 396	904, 640	13, 330, 000	22, 216	1, 333, 000	121, 000	172, 857	3, 977, 270
Virginia	1, 080, 000	16, 119	777, 600	48, 000, 000	64, 000	4, 992, 000	128, 000	148, 837	2, 720, 000
North Carolina	848, 000	8, 233	593, 600	13, 200, 000	19, 819	1, 320, 000	90, 000	75, 000	1, 273, 500
South Carolina	73, 000	912	73, 000	50, 000	83	6, 000	17, 300	17, 300	622, 800
Georgia	202, 000	2, 195	256, 540	350, 000	700	62, 300	17, 600	11, 972	445, 456
Florida									
Alabama	147, 000	1, 934	169, 050				13, 900	13, 900	254, 787
Mississippi	209, 000	2, 458	242, 440				12, 400	9, 920	299, 336
Louisiana	62, 000	1, 127	53, 940				12, 900	11, 517	300, 957
Texas	270, 000	2, 454	510, 300				34, 400	30, 442	465, 088
Arkansas	397, 000	5, 089	404, 940	875, 000	921	145, 250	12, 400	10, 782	248, 000
Tennessee	1, 122, 000	14, 571	639, 540	25, 000, 000	33, 422	2, 925, 000	117, 000	96, 694	1, 808, 820
West Virginia	833, 000	12, 815	499, 800	2, 300, 000	4, 000	250, 700	173, 300	188, 043	2, 866, 610
Kentucky	2, 145, 000	30, 642	1, 244, 100	130, 000, 000	167, 741	10, 920, 000	352, 000	266, 666	4, 607, 680
Ohio	7, 751, 000	96, 887	4, 883, 130	30, 000, 000	28, 571	2, 430, 000	1, 730, 000	1, 730, 000	24, 963, 900
Michigan	6, 009, 000	91, 045	3, 785, 670				1, 050, 000	981, 308	12, 873, 000
Indiana	2, 801, 000	40, 014	1, 512, 540	16, 250, 000	22, 965	1, 137, 500	859, 000	692, 741	10, 763, 270
Illinois	9, 668, 000	128, 906	4, 447, 280	7, 500, 000	8, 823	637, 500	1, 929, 000	1, 428, 888	18, 267, 630
Wisconsin	5, 226, 000	53, 876	2, 299, 440	3, 250, 000	3, 170	279, 500	1, 398, 000	1, 051, 127	13, 728, 360
Minnesota	2, 216, 000	22, 383	576, 160				803, 000	594, 814	4, 553, 010
Iowa	6, 631, 000	55, 258	1, 458, 820				1, 664, 000	1, 232, 592	10, 100, 480
Missouri	3, 171, 000	39, 637	1, 585, 500	16, 500, 000	15, 434	1, 567, 500	601, 000	500, 833	5, 847, 730
Kansas	3, 797, 000	42, 188	1, 594, 740				728, 000	539, 259	2, 831, 920
Nebraska	958, 000	8, 709	268, 240				189, 000	135, 000	720, 090
California	1, 900, 000	32, 203	2, 147, 000				620, 000	413, 333	9, 672, 000
Oregon	482, 000	4, 725	265, 100				77, 900	57, 703	1, 343, 775
Nevada	173, 000	1, 235	346, 000				52, 000	29, 714	1, 040, 000
The Territories	875, 000	6, 433	577, 500				148, 000	87, 058	1, 824, 840
Total	113, 516, 000	1, 331, 331	68, 091, 120	342, 304, 000	416, 512	35, 730, 385	23, 812, 800	20, 318, 936	345, 969, 079

A general summary, showing the estimated quantities, number of acres, and aggregate value of the principal crops of the farm in 1872.

Products.	No. of bushels.	No. of acres.	Value.
Indian corn .... bushels..	1, 092, 719, 000	35, 526, 836	$435, 149, 290
Wheat .... do....	249, 997, 100	20, 858, 359	310, 180, 375
Rye .... do....	14, 888, 600	1, 048, 654	11, 363, 693
Oats .... do....	271, 747, 000	9, 000, 769	91, 315, 710
Barley .... do....	26, 846, 400	1, 397, 082	19, 837, 773
Buckwheat .... do....	8, 133, 500	448, 497	6, 747, 618
Potatoes .... do....	113, 516, 000	1, 331, 331	68, 091, 120
Total	1, 777, 847, 600	69, 611, 528	942, 685, 579
Tobacco .... pounds..	342, 304, 000	416, 512	35, 730, 385
Hay .... tons..	23, 812, 800	20, 318, 936	345, 969, 079
Cotton .... bales..	3, 500, 000	8, 500, 000	301, 087, 500
Total	....	98, 846, 976	1, 625, 472, 543

Table showing the average yield and cash value, and price per bushel, ton, or pound, of farm products for the year 1872.

Products.	Average yield per acre.	Average price per bushel.	Average value per acre.	Products.	Average yield per acre.	Average price per bushel, ton, or pound.	Average value per acre.
Indian corn.... bush.	30. 7+	$0 39. 8+	$12 24	Buckwheat ..... bush.	18. 1 +	$0 82. 9+	$15 04
Wheat .... do..	11. 9+	1 24. 0+	14 87	Potatoes .... do..	85. 2 +	59. 9+	51 14
Rye .... do..	14. 1+	76. 3+	10 83	Tobacco .... lbs.	821. 8 +	10. 4+	85 78
Oats .... do..	30. 1+	33. 6+	10 14	Hay .... tons.	1. 17+	14 52. 8+	17 02
Barley .... do..	19. 2+	73. 8+	14 19	**Cotton** .... lbs.	191. 4 +	18. 5	35 42

Table showing the average yield per acre and price per bushel, pound, or ton, of farm products for the year 1872.

States.	CORN.		WHEAT.		RYE.		OATS.		BARLEY.		BUCKWHEAT.		POTATOES.		TOBACCO.		HAY.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Pounds.	Price per pound.	Tons.	Price per ton.
Maine	33.5	$0 94	16.	$1 92	18.1	$1 09	29.5	$0 50	20.6	$0 83	25.5	$0 65	75	$0 68	......	......	.92	$12 80
New Hampshire	38.2	95	16.5	1 84	19.5	1 04	33.	59	27.5	92	19.	57	94	87	1,500	$0 27.5	1.02	14 66
Vermont	39.	84	16.	1 74	17.7	1 13	35.2	48	22.	86	20.	64	107	53	1,450	25.	1.16	13 00
Massachusetts	34.	90	17.4	1 95	17.5	1 03	30.4	61	23.2	76	14.2	90	102	88	1,750	29.5	1.12	21 37
Rhode Island	30.	90	......	......	16.3	98	35.6	50	23.	90	......	......	90	90	......	......	1.02	32 50
Connecticut	31.2	92	17.	1 65	15.8	1 10	35.8	61	23.1	90	19.2	96	100	82	1,650	30.	1.13	26 05
New York	37.5	70	12.5	1 65	13.5	89	35.	44	23.5	81	18.5	83	88	63	1,033	9.	1.25	18 60
New Jersey	39.5	62	13.5	1 73	13.	88	27.4	48	23.5	92	15.5	1 00	75	87	......	......	1.15	31 60
Pennsylvania	39.	60	10.8	1 67	13.4	86	31.2	43	18.4	88	20.	93	99	63	1,300	14.6	.98	22 84
Delaware	20.	55	9.2	1 60	7.5	82	15.5	42	15.4	85	20.	90	75	1 00	......	......	.80	30 00
Maryland	23.	57	8.5	1 68	11.6	79	14.3	40	15.	78	15.	80	53	88	600	10.	.70	32 87
Virginia	21.	58	8.4	1 56	13.5	72	13.	46	17.5	75	14.2	62	67	72	750	10.4	.86	21 25
North Carolina	16.	62	8.2	1 53	7.4	93	13.8	80	15.5	78	11.8	69	103	70	666	10.	1.20	14 15
South Carolina	10.5	96	6.1	1 88	7.5	1 48	8.	80	15.5	80	......	......	80	1 00	600	12.	1.	36 00
Georgia	12.5	86	9.	1 73	10.2	1 56	12.5	83	13.5	95	......	......	92	1 27	500	17.8	1.47	25 31
Florida	9.6	1 20	......	......	......	......	11.2	93	......	......	......	......	......	......	......	......	......	......
Alabama	17.6	78	9.5	1 48	11.	1 28	12.6	82	......	......	......	......	76	1 15	......	......	1.	18 33
Mississippi	17.5	88	10.3	1 57	9.	1 75	12.5	1 06	......	......	......	......	85	1 16	......	......	1.25	24 14
Louisiana	18.5	88	......	......	......	......	19.1	1 32	......	......	......	......	55	87	......	......	1.12	23 33
Texas	25.3	43	18.5	1 65	17.2	1 38	25.4	81	25.	1 00	......	......	110	1 89	......	......	1.13	13 52
Arkansas	23.5	73	10.4	1 52	12.5	1 50	24.5	64	......	......	......	......	78	1 02	950	16.6	1.15	20 00
Tennessee	23.5	48	9.6	1 40	9.2	88	18.7	42	18.5	78	7.5	95	77	57	748	11.7	1.21	15 46
West Virginia	28.5	55	10.3	1 43	13.5	88	24.1	38	11.5	95	13.4	88	65	60	575	10.9	.92	16 57
Kentucky	31.2	37	12.	1 29	15.1	73	24.6	49	22.	73	15.2	1 00	70	58	775	8.4	1.32	13 09
Ohio	39.5	34	11.7	1 42	11.2	73	30.	29	23.2	71	13.	94	80	63	1,050	8.1	1.	14 43
Michigan	36.	43	12.	1 46	14.	74	30.	32	23.6	81	15.8	76	66	63	......	......	1.07	12 26
Indiana	38.7	29	12.4	1 32	14.5	65	30.5	25	24.	69	14.5	85	70	54	716	7.	1.24	12 53
Illinois	39.8	24	12.1	1 23	18.1	50	36.6	19	26.1	55	15.	81	75	46	850	8.5	1.35	9 47
Wisconsin	38.	40	14.3	1 03	16.8	57	35.5	32	28.6	57	17.5	60	97	44	1,025	8.6	1.33	9 82
Minnesota	35.2	36	16.5	83	77.7	49	36.5	26	26.7	42	18.7	90	99	26	......	......	1.35	5 67
Iowa	39.8	18	12.6	85	19.5	47	36.7	16	27.9	42	20.1	69	120	22	......	......	1.35	6 07
Missouri	37.	32	8.8	1 41	16.	71	32.7	23	23.	73	18.9	76	80	50	1,069	9.5	1.20	9 73
Kansas	38.5	22	11.6	1 42	17.5	71	32.5	22	22.5	60	17.2	90	90	42	......	......	1.35	3 89
Nebraska	37.8	18	12.2	78	15.5	40	37.5	16	25.5	39	18.5	71	110	28	......	......	1.40	3 81
California	35.	1 00	12.2	1 11	12.	1 02	25.	74	12.2	85	21.	1 11	59	1 13	......	......	1.50	15 60
Oregon	28.	93	18.2	74	23.2	73	28.2	51	24.6	60	18.6	83	102	55	......	......	1.35	17 25
Nevada	33.	1 50	25.	1 75	......	......	35.	1 00	30.	1 50	......	......	140	2 00	......	......	1.75	20 00
The Territories	33.4	86	23.5	1 04	24.	78	38.	75	30.	94	......	......	136	66	......	......	1.70	12 33

Table showing the average cash value of farm products per acre for the year 1872.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buck-wheat.	Pota-toes.	Tobacco.	Hay.
Maine	$31 49	$30 72	$19 72	$14 75	$17 09	$16 57	$51 00	....	$11 77
New Hampshire	36 29	30 36	20 28	19 47	25 30	10 83	81 78	$412 50	14 95
Vermont	32 76	27 84	20 00	16 89	18 92	12 80	56 71	362 50	15 08
Massachusetts	30 60	33 93	18 02	18 54	17 63	12 78	89 96	516 25	23 93
Rhode Island	27 00	....	15 97	17 80	20 70	....	81 00	....	33 15
Connecticut	28 70	28 05	17 38	21 83	20 79	18 43	82 00	495 00	29 43
New York	26 25	20 62	12 01	15 40	19 03	15 35	55 44	92 97	23 25
New Jersey	24 49	23 35	11 44	13 15	21 62	15 50	65 25	....	36 34
Pennsylvania	23 40	18 03	11 52	13 41	16 19	18 60	62 37	189 80	22 38
Delaware	11 00	14 72	6 15	6 51	13 09	18 00	75 00	....	24 00
Maryland	13 11	14 28	9 16	5 72	11 70	12 00	46 64	60 00	23 00
Virginia	12 18	13 10	9 72	5 98	13 12	8 80	48 24	78 00	18 27
North Carolina	9 92	12 54	6 88	11 04	12 09	8 14	72 10	66 60	16 98
South Carolina	10 08	11 46	11 10	6 40	12 40	....	80 00	72 00	36 00
Georgia	10 75	15 57	15 91	10 37	12 82	....	116 84	89 00	37 20
Florida	11 52	....	....	10 41	....	....	....	....	....
Alabama	13 72	14 06	14 08	10 33	....	....	87 40	....	18 33
Mississippi	15 40	16 17	15 75	13 25	....	....	98 60	....	30 17
Louisiana	16 28	....	....	25 21	....	....	47 85	....	26 12
Texas	10 87	30 52	23 73	20 57	25 00	....	207 90	....	15 27
Arkansas	17 15	15 80	18 75	15 68	....	....	79 56	157 70	23 00
Tennessee	11 28	13 44	8 09	7 85	14 43	7 12	43 89	87 51	18 70
West Virginia	15 67	14 72	11 88	9 15	10 92	11 79	39 00	62 67	15 24
Kentucky	11 54	15 48	11 02	12 05	16 06	15 20	40 60	65 10	17 27
Ohio	13 43	16 61	8 17	8 70	16 47	12 22	50 40	85 05	14 43
Michigan	15 48	17 52	10 36	9 60	19 11	12 00	41 58	....	13 11
Indiana	11 22	16 36	9 42	7 62	16 56	12 32	37 80	50 12	15 53
Illinois	9 55	14 88	9 05	6 95	14 35	12 15	34 50	72 25	12 78
Wisconsin	15 20	14 72	9 57	11 36	16 30	10 50	42 68	88 15	13 06
Minnesota	12 67	13 69	8 67	9 49	11 21	16 83	25 74	....	7 65
Iowa	7 16	10 71	9 16	5 87	11 71	13 86	26 40	....	8 19
Missouri	11 84	12 40	11 36	7 52	16 79	14 36	40 00	101 55	11 67
Kansas	8 47	16 47	12 42	7 15	13 50	15 48	37 80	....	5 25
Nebraska	6 80	9 51	6 20	6 00	9 94	13 13	30 80	....	5 33
California	35 00	13 54	12 24	18 50	10 37	23 31	66 67	....	23 40
Oregon	26 04	13 46	16 93	14 38	14 76	15 43	56 10	....	23 28
Nevada	49 50	43 75	....	35 00	45 00	....	280 00	....	35 00
The Territories	28 72	24 44	18 72	28 50	28 20	....	89 76	....	20 96

Total average cash value per acre.

States.	Average value per acre.	States.	Average value per acre.
Maine	$14 16	Texas	$12 84
New Hampshire	19 50	Arkansas	17 60
Vermont	17 87	Tennessee	12 70
Massachusetts	31 10	West Virginia	15 04
Rhode Island	34 00	Kentucky	15 54
Connecticut	33 94	Ohio	14 57
New York	22 94	Michigan	15 65
New Jersey	27 96	Indiana	13 51
Pennsylvania	20 80	Illinois	11 13
Delaware	13 24	Wisconsin	14 28
Maryland	15 22	Minnesota	11 83
Virginia	14 15	Iowa	8 49
North Carolina	11 38	Missouri	11 99
South Carolina	10 45	Kansas	8 92
Georgia	11 68	Nebraska	7 75
Florida	11 47	California	15 12
Alabama	13 77	Oregon	16 70
Mississippi	15 61	Nevada	44 30
Louisiana	16 57	The Territories	26 17

CONDITION OF FARM-ANIMALS.

The losses of the year 1872, through neglect and severity of the winter in the western plains and mountains, where provision for shelter and feed is not usually made, were greater than usual in the Southern States, Kansas, Nebraska, Wyoming, and Northern Colorado. Winters exceptionally severe, and storms of comparative severity, which occur every winter, should be met with adequate provision in all stock-growing regions. While pecuniary considerations appear to govern the actions of farmers in the care of dumb brutes committed to their protection, it is hoped that no respectable stock-grower will disregard the common dictates of humanity, in his treatment of his dependents. A close view of the subject will show that its monetary and merciful aspects are usually in harmony; and a man, who is a man indeed, will be willing to make some pecuniary sacrifices, in emergencies, rather than subject his farm-stock to avoidable suffering. We have become so accustomed to reckoning upon an annual loss of millions of dollars, from lack of food and shelter in periods of storm and cold, that we are apt to look upon it as an unavoidable calamity, and a necessary drawback to the profits of stock-growing.

Horses and mules, the most valuable class of domestic animals, receive more uniformly the requisite care and protection than other stock. If hay is scarce the deficiency is usually made good by extra supplies of grain; and yet the colts and young horses of thinly-settled States are often left to the same chances for pasturage, and shelter from the rigors of winter, that are the lot of the less valuable stock of the range. With the exception of suffering from the severity of the winter among this class of unstabled horses, mainly in the milder climates of the country, both horses and mules escaped unusual suffering, and were reported through the season comparatively exempt from any prevailing visitation of disease. A brief generalization only of the facts in the reports of the year will be attempted.

CONDITION OF STOCK IN THE SPRING.

CATTLE.—The short hay crop, and the severity of the winter, taxed the feeding resources of Maine farmers to the utmost. The numbers were reduced as much as possible in the autumn, an unusual quantity of grain was fed, and yet many died. The deficient supply was not made good. The reports hint at the general scarcity of forage. In York "a large proportion are in fair condition, but some persons are short of hay, and choose to stint their stock rather than buy;" in Franklin cattle were reported in good order.

New Hampshire reports of condition were more favorable, except that in Coos cattle were "thin but healthy." In Hillsborough superior condition resulted from better care and the feeding of grain.

Similar accounts come from Vermont; the least favorable from Addison, Windsor, and Orange. In many instances the low price of beef induced farmers to attempt to keep over too much stock for the grain supplies. Animals were sustained in fine flesh in Grand Isle and Windham.

Massachusetts reports indicated about average condition; only Dukes and Norfolk were below, while Hampden and Franklin were the only counties above an average.

In Rhode Island, cattle were "poor but healthy" in Providence, com-

paratively poor in Washington, but excellent in Bristol on account of better care and more abundant food supplies.

Favorable reports come from Connecticut, except from the counties of Middlesex and New London, where a scarcity of hay existed, maximum prices being quoted at $40.

Cattle were wintered successfully in New York; reports from thirty-six counties representing condition from average up to excellent, (in Niagara,) and "never better," (in Saratoga;) while a few counties, as Ontario, Rensselaer, and Suffolk, where hay sold at $20 to $30, made less favorable returns. In Genesee cattle were housed about six months. In Onondaga there was some complaint of cows not doing well when "coming in."

The only counties in New Jersey where the short crop of hay, supplemented with sown corn fodder and other special forage, failed to keep cattle in fair order, were Cumberland, Salem, and Cape May.

Of thirty-five counties in Pennsylvania reporting, the most unfavorable accounts came from Butler, where forage was very deficient; Clearfield, Luzerne, Union, Forest, Adams, Cameron, and McKean suffered from short supplies; in the remaining counties there was little cause for unfavorable comparison. The Sullivan correspondent said: "Improved buildings and accommodations have told favorably upon the condition of cattle; and the fear of insufficiency in the supply of provender prevented selling of grain and induced farmers to take more than usual care of their hay. The result is that cattle look well and will not suffer for provender."

The condition of cattle in Delaware was a full average.

In Maryland a scarcity of feed existed, but the feeding of an unusual amount of grain in Harford, Cecil, Carroll, Montgomery, Queen Anne, Calvert, and Anne Arundel, made good the deficiency; but all extra supplies proved insufficient in Washington, Kent, and Baltimore.

Nearly all of the sixty-three county reports in Virginia told of comparatively poor stock, owing to the "severe winter and insufficient food." The poverty of supplies is indicated by the report for Mecklenburgh: "The utter failure of the wheat and oat crops compelled the use of straw and corn fodder for teams, leaving only what could be picked up in the fields, and corn-stubble, for the cattle, and many have starved in consequence." The only counties giving anything like a favorable report were Amelia, Highland, Henry, Pulaski, Montgomery, Botetourt, and Alexandria.

In more than three-fourths of the counties of North Carolina cattle were represented to be in sorry plight after passing through an unusually trying ordeal. In fact, the winter was not over on the 1st of April in some parts of the State, and fears were freely expressed of serious losses from exhaustion of provender before the appearance of spring pasture, such losses actually occurring in many places. Very few county reporters failed to note the severity of the season, the "oldest inhabitant" taxing his memory in vain for a parallel, while the scarcity of food of all kinds seems to have been almost as general, caused, in part, by the unusual demand upon it, and also by the drought of the preceding summer. In Hertford County the exceedingly bad condition is accounted for by the fact that the young reeds, upon which the cattle depend for winter food, were killed by the cold.

Greenville and Fairfield Counties alone, in South Carolina, made favorable returns, scarcity or entire exhaustion of provender being generally complained of, and superlatively bad reports being the rule, based upon the lack of food and the rigors of an exceptionally cold winter and

late spring, which unfavorable conditions were aggravated by a general absence of suitable shelter from the inclemency of the season.

In Georgia the winter was one of great severity, the cold weather and excessive rains telling fearfully upon cattle. Troup County alone, out of sixty-three reporting, returned condition as "excellent," and but nine others reported at all favorably; while in the remainder the expressions "deplorable," "worse than for many years," &c., were so frequent as to become almost monotonous. In some parts of the State an unusual amount of snow fell, and from all quarters the scarcity of provender was complained of, resulting in many losses from starvation.

From Florida came the same accounts of the unusual inclemency of the season, with consequent suffering and many losses, although the condition was improving on the 1st of April, and in Levy County the increase of calves was reported at 100 per cent. greater than usual. But two counties heard from (Jefferson and Volusia) made favorable returns.

Lack of food and shelter, together with severity of winter and lateness of spring, were the causes assigned by correspondents in Alabama for the low condition of cattle generally, few counties breaking the uniformity of the report, Lowndes, Lauderdale, and Morgan alone forming prominent exceptions; in the first "better care," and in the last "the dry winter," furnishing explanations of the favorable aspect of affairs.

From Mississippi the returns were hardly more cheering, containing reiterations of the same depressing statements. The season throughout the South was extremely trying to stock unprovided with shelter, and depending almost entirely upon the range for subsistence. The reports of heavy losses from actual starvation were frequent, amounting to 50 per cent. of some herds in Newton County. In Wayne, also, many losses were reported, and a rapid deterioration in the ranges has caused a decrease of 80 per cent. in some herds within the past eighteen years.

Several reports from Louisiana were favorable, but the majority represented cattle as suffering from the severity of the winter. The need of care and shelter is repeatedly acknowledged. The La Fourche reporter acknowledged that "cattle needed shelter, as in the North." In some places the losses are heavy, especially on the Attakapas prairies, where one stock-raiser lost four hundred to five hundred out of three thousand, one hundred dying immediately after the snow-storm of March 1. Thousands of cattle are estimated to have perished in Louisiana from exposure.

Three-fifths of the returns from Texas represented condition of cattle below an average. Among the counties in which stock was in "good" or superior condition are Red River, Fort Bend, Ellis, "better than for many years," Colorado, "better than ever before," Grayson, Blanco, Austin, Kendall, Williams, Hunt, "better than for two years," Titus, Collin, Galveston, Harris, Marion, Bell, and Anderson. The following extracts present a less desirable aspect of the case:

Medina, Texas.—Many losses, principally of old cows, from insufficient pasture on the prairies, owing to the dry fall.

Rusk, Texas.—Poor; no shelter but the forest, and no food but dry grass and shrubs.

Nueces, Texas.—Very poor. Unusually dry for the past year, and water scarce. Cattle died by thousands in the winter, and if we have no rain soon many cows will be unable to raise their calves.

Refugio, Texas.—Wretched, and the loss frightful, the result of the ruinous system of turning the cattle out upon the prairies with no provision for the contingencies of bad weather.

Bee, Texas.—Loss 25 per cent. Not less than fifteen thousand cattle have died of starvation and cold weather. Ten thousand hides saved.

While the winter in Arkansas was unusually severe, the condition of farm-animals was good in a majority of the counties. In Independence County cattle were represented to be in a wretched condition, worse than for fifteen years; and very poor in Montgomery, where there are "no winter-quarters but the woods, and woods pastures are gradually deteriorating, so that all cattle will soon have to be fed in winter."

A majority of reports from Tennessee are comparatively favorable. The counties making the best returns are Wayne, Johnson, Meigs, Lawrence, Robertson, Rhea, Polk, Coffee, Putnam, Decatur, Blount, Humphreys, and Obion. In Putnam "more attention is given to sheltering." Sevier had the "severest winter for fifteen years."

The favorable returns from Kentucky greatly outnumber those of poor condition. The winter was long and severe, and feeding was continued late.

A majority of the reports from the Ohio Valley and Lake States were decidedly favorable, many referring to better care bestowed on cattle. Regular feeding and salting were accorded a share of the credit of good condition; the favorable weather, and especially the absence of storms of sleet, were important auxiliaries. In some localities exceptions appeared, as in Greenbrier, West Virginia, where a few graziers cut down linn and sugar maples for browse, and in Berkeley, where cattle were greatly reduced by exposure and fasting.

West of the Mississippi, except in Iowa and Minnesota, where some attention is given to shelter for stock, there were suffering and loss.

In Missouri only twelve of seventy-two counties reporting showed superior condition.

In Kansas and Nebraska the suffering was great and the losses heavy, particularly among the unacclimated Texas cattle, immense numbers of which were kept over by drovers, in preference to selling at autumn prices. Where cattle were properly sheltered and fed they did well. The following extracts refer to extreme cases of loss, mostly in Texan cattle:

KANSAS.—*Osage:* Many cattle very weak, others dying; seem to be starving to death while fed an abundance of prairie-hay which was cut very rank. Only straw and corn fodder has kept cattle alive. One man lost three hundred and fifty Texans out of six hundred. Many Texas cows do not give milk enough to keep their calves alive. *Marion:* Losses through starvation from 20 to 75 per cent.; last fall most of the prairie-grass was burned. Native cattle average; Texas horribly poor. *Dickinson:* Very poor and weak. Lack of shelter and food. Thousands of Texans have died. *Washington:* Native cattle fair; Texas and Cherokee very poor; many dying from inanition. *Saline:* Winter harder than ever known. Native cattle have lost lightly; Texans about one-third. *Sumner:* Stock went into winter-quarters poor and are coming out poorer. Cattle kept in the range without feeding have suffered fearfully, some herds losing 75 per cent. and others 50 per cent. Those feeding hay have lost less, from 10 to 25 per cent. A series of cold rains would just now complicate matters seriously. *Neosho:* Native cattle good; Texas cattle very poor. *Morris:* Texas cattle lost from 35 to 50 per cent. Domestic cattle in good condition. *Greenwood:* Winter severe on cattle; hay less nutritious than usual; no tame grass sown; wet summer made the prairie-grass rank and poor; very litte shelter provided; hence more native cattle have died than usual, and the survivors are quite poor. Texas cattle have suffered still more; losses from 20 to 50 per cent. *Lincoln:* Very poor, generally speaking; cattle have met with heavy losses. Of a herd of 431 Texas and 133 native cattle, one-half of the former and one-fourth of the latter have died. About 8,000 Texan cattle wintered in the county.

NEBRASKA.—*Nemaha:* Condition fair, feed plenty. Texas cattle have suffered from bad weather, and some have died. *Madison:* Cattle sheltered have done well, but very many have died from lack of shelter. *Boone:* Rather thin; many settlers came too late to put up hay. *Webster:* Cattle have suffered severely; large herd of Texas cattle have died, besides many natives.

While there were some losses in Wyoming and Northern Colorado, from the extreme severity of the winter, they were evidently no greater

than in Nebraska or Kansas, and scarcely heavier than in Texas. The grasses, dwarfed and unusually dry in some localities from the drought of last summer, were more nutritious than those of moister climates.

All the reports from Dakota were favorable; some representing stock to be in better order than usual, "notwithstanding the extreme cold."

The stock of the Indian Territory was reported comparatively poor, but generally healthy.

Colorado and Wyoming experienced a very severe winter, "the severest ever known," as some report, with much snow covering the grasses of the plains, and driving herds to the bare foot-hills, often crowding the range and threatening starvation. Yet many herds in these Territories kept in good condition, having suffered little loss. From El Paso County, Colorado, which has a very high elevation, the report was, "fine condition, better than last year." The winter tested the reliability of this region for winter stock-feeding, and proved that a limited number, with proper attention, suitable natural or artificial protection, and feeding in storms or heavy snows, can be cheaply kept, with as good a prospect of immunity from suffering or loss as in almost any other section of the country.

In New Mexico the winter was exceptionably favorable for stock-raisers, and almost equally advantageous in Utah; only in Summit County were cattle "generally poor, the winter being unusually wet and stormy."

The severe droughts in Arizona, for two or three seasons past, interfered sadly with the condition of stock in that Territory.

In Montana, cattle were thin but healthy; and in Washington they wintered well, as also in Nevada, and in Oregon, except where entirely neglected.

In South California the drought of last season left little feed for winter, and cattle suffered much in the early part of the season. Favorable returns came from Plumas, Santa Clara, Del Norte, Lake, Mendocino, Tuolumne, and most of the northern counties.

SHEEP.—This class of farm-animals have received more care than for several years past, and show greater exemption from disease and debility. The advance in the price of wool has been an incentive to increased attention to the comfort and well-being of flocks. In places where a scarcity of hay existed, and a coarser substitute was not availble, grain was fed with a good degree of liberality. In some of the more northern States, owing to the length of the winter, the coming of the early lambs was unseasonable, and large numbers died. In Oxford and Hancock, Maine, and in three or four other counties in New England, some mortality was caused by cold and insufficient nutrition, there being a great scarcity of hay. Unusually favorable weather—freedom from rain-storms and sleet—conduced to average and even high condition of sheep in New York, and throughout the Middle States, except in cases of neglect and scarcity of forage. Less favorable accounts come from the Southern States, where no provision is made for either feed or shelter, as a rule. Losses of lambs in spring were very general. In Conecuh County, Georgia, a loss of two-thirds of the lambs was reported, even though the dams were looking well; and severe losses of lambs were reported from all parts of the South. Throughout the West sheep wintered remarkably well, the exceptions being few; and loss of lambs was mentioned in comparatively few reports. The winter in California was comparatively severe; in some of the counties pasturage was injured by drought and the result was poor condition in such locations. San Diego, Stanislaus, Sonoma, and San Bernardino made unfavorable reports, while Del

Norte, Tuolumne, and other counties which had not suffered from drought, represent a better condition of sheep than usual.

DISEASES OF FARM-ANIMALS.

Disease has not cut off an unusual number of farm-animals the past year. Where cattle are most valuable, whatever the rigors of the climate or local scarcity of feed, the loss by disease is comparatively small, by reason of the care which is found by long and bitter experience to be profitable. A large proportion of the losses reported is the result of neglect, exposure, and insufficient or innutritious pasturage or other feed. Some mortality and much reduction of flesh result from the inhumanity of drovers, with the aid or abetting of transportation companies. Several deaths were reported at Allegheny City, resulting from the barbarous practice of stuffing animals with salted feed to induce them to drink largely, for the purpose of making good upon the scales the depreciation in weight occasioned by the deprivation and suffering of the passage by rail. The occurrence of "murrain," "hollow horn," and diseases reported by various meaningless names, so common in the Southern States, where cattle are left to the tender mercies of a rigorous winter, and dead, woody stalks of coarse grasses, might be avoided in a large measure by adequate supplies and shelter.

The rigors of winter proved conclusively the necessity of protection, not only in the more northern of the southern states, but in Texas, where large numbers of cattle, estimated variously at 100,000 to 200,000 head, have succumbed to the combined agencies of cold and starvation. The pretence that shelter is unnecessary on the elevated plains of Colorado and Wyoming is also exploded, large losses, especially of Texas cattle, having occurred during the winter. It is true that small herds, and in some cases large ones, have been sheltered in the cañons and in the lee banks of streams, and wintered with little loss; but it is unmerciful and untrue, to assert that no provision for shelter is or will be necessary in those elevated pasture-grounds of the plains and Rocky Mountains.

HORSES.—Horses have suffered less than in some previous years. Cases of the various forms of disease reported have generally been isolated.

Lung-fever.—Horses have been comparatively free from this disease throughout the country. Several fatal cases are reported from Aroostook County, Maine. The animals were affected with what at first appeared to be a violent cold, soon followed by prostration and death. Franklin County, Vermont, reports two deaths from this cause. A few fatal cases are also reported from Chester County, Pennsylvania, and Upshur County, West Virginia. The correspondent for Queen Anne County, Maryland, in writing of this disease, says: "Many horses die shortly after the attack, from want of timely and proper attention; but when taken in time the disease will almost universally yield to proper treatment and careful diet."

Pneumonia.—But few cases are reported. It was, however, the prevailing disease reported by the correspondent for Providence County, Rhode Island; and a few cases are heard from in Queens County, New York.

Staggers is reported in Moore County, North Carolina; cases also occurred in Bladen and Craven Counties. In the latter county it attacked young animals chiefly, destroying at least 50 per cent. of those attacked. Losses are also reported from Fairfield County, South Carolina, supposed to have been caused by eating unsound corn, or that

which had been overflowed in low lands. Wilkinson County, Georgia, reports some cases; also Tuscaloosa County, Alabama; Lee County, Mississippi; Cherokee County, Texas; Jackson County, Arkansas; Coffee and Lauderdale Counties, Tennessee.

Glanders.—But few cases are mentioned. Several died in Litchfield County, Connecticut; a few in Surry County, Virginia, and Hillsborough County, Florida. It has prevailed in Winston County, Mississippi; Mercer County, West Virginia, reports a few cases; and Trimble County, Kentucky, reports fifteen or twenty.

Distemper, spoken of by many reporters as diphtheria, has existed, but doubtless the majority of cases so described were nothing more than those of ordinary distemper. The correspondent for Niagara County, New York, says the disease proved fatal at first, but after a little experience was treated successfully. Cases are also reported from Luzerne County, Pennsylvania, where it is termed a "malignant distemper;" Buncombe County, North Carolina; Chesterfield County, South Carolina; Orange, Hillsborough, Manatee, and Santa Rosa Counties, Florida; Choctaw County, Alabama; in Victoria, Austin, and Nueces Counties, Texas, many colts, and, in some cases, grown animals, have died; in Izard County, Arkansas; Upshur County, West Virginia; Lewis County, Kentucky; Madison County, Indiana, and in Boone County, Illinois. Sonoma County, California, an "epizootic distemper" is spoken of; the cases yield readily to treatment.

Farcy.—A few cases have occurred within a short time in Buckingham County, Virginia. The disease was originally introduced by the Army horses, in 1865. Every case heard from in this county proved fatal, obstinately resisting all remedies. Choctaw County, Alabama, reports a few cases.

Charbon is reported only from Phillips County, Arkansas. The treatment adopted was to sear the affected part with a hot iron and scarify the wound a few days afterward.

Quinsy prevailed only in Baltimore County, Maryland, and, though not often fatal, interfered very much with farm-work last spring.

Bots.—A few animals were attacked in Winston County, Mississippi, and Obion County, Tennessee. Cases of "new" or "unknown" diseases were reported, and some in which the symptoms are not given with sufficient fullness for classification. The correspondent for Norfolk County, Massachusetts, stated that a "large number of horses belonging to the street-railroad companies have been affected with a new disease. It has proved fatal in several cases, and as yet no positive remedy has been discovered." In Litchfield County, Connecticut, deaths resulted from a disease resembling farcy, or glanders. In Washington County, Pennsylvania, seven died of an affection resembling inflammation of the intestines. The reporter for York County, Virginia, says: "Nearly all the horses died on one farm from some unknown cause." In Wakulla County, Florida, many losses occurred, especially among mules. "On examination, the intestines were found to be filled with sand." In Crittenden County, Arkansas, buffalo gnats kill more than all the diseases. Huntingdon County, Indiana, reports numerous deaths from diseased lungs, throat, and head. The correspondent for Peoria County, Illinois, says: "A neighbor of mine raised Hungarian grass last year for hay; fed it to his horses during winter; one horse became entirely disabled, 'stiff;' the animal finally recovered." Several horses died of a new disease in Dickinson County, Kansas, the symptoms of which are as follows: "Cough, yellow matter running from the nose, swelling of the throat, increasing weakness, and death. It is not dis-

temper or glanders; veterinary surgeons do not know what to do with it, nor what it is."

CATTLE.—*Splenic* (*Texas*) *fever*.—A few cases of this noteworthy climatic disease were reported. The same distinctive features mark every outbreak. New evidences that its germ originates in the miasmatic or tide-water region, not only in Texas, but in all the coast-lands from Texas to Virginia, accumulate yearly. Our correspondent in Fluvanna County, Virginia, (north of the James River, between Richmond and Lynchburgh,) thus writes:

There are some strange facts connected with the cattle-disease common to the lower tide-water counties of Virginia, known commonly as murrain, bloody urine, or distemper, which may throw some light on the Spanish fever following in the track of Texan cattle. In certain districts of this State murrain has always prevailed in certain seasons, attacking most frequently young and fat cattle of both sexes. It is well understood that if cows are removed from Upper Virginia to Richmond, or the lower counties, they are very apt to die the first year, whereas cattle brought from the lower counties up to Richmond escape. For this reason milch cows brought from Gloucester and other lower counties are much preferred by Richmond buyers; yet in Gloucester I have known seven cows out of ten to die of murrain in one fall. Again, throughout certain counties on the south side of the James River, extending to the North Carolina line, cattle are subject to murrain, while in other counties directly abreast of them, on the north side of the river, the disease is unknown, unless communicated by cattle brought from the south side, that in some way infect them, while those from the south side keep well. There seems, then, to be some inherent taint in the constitution of cattle living in certain regions, which may be communicated by contact, and this, while in some cases traceable to climate, in others exists when we can discover no difference in climate. A long acquaintance with Texan cattle introduced into Louisiana warrants the opinion that they neither die themselves of this disease, nor communicate it to the native herds in Louisiana.

The fact that Texas cattle do not communicate the disease to Louisiana stock is well known, and the reason is obvious, viz, both sections are miasmatic. The coast cattle do not communicate splenic fever to other coast cattle, but to herds above tide-water. The fact is indisputable that cattle of the tide-water counties of Virginia, the Carolinas, Georgia, Florida, and other States on the Gulf coast, do communicate a fatal disease to stock of higher elevations and more salubrious climate, and that this disease has very marked and distinguishing symptoms and peculiarities which are almost invariable. A correspondent in Murray County, Georgia, writes of a disease which he thinks, from *post-mortem* examination, presented "well-marked and clearly-defined cases of splenic fever." He says it has broken out each summer, since 1865, and continues until frost. He does not describe its attendant circumstances and symptoms, or say whether its advent was heralded by the coming of coast cattle. It may, therefore, or may not, be the veritable splenic fever. Murray County lies in the northwest corner of the State, toward Chattanooga, and appears to have a climate in which the splenic contagion might take. In Gilmer, an adjoining county, are reported "a few cases of Spanish (splenic) fever, among cattle brought from more southern latitudes." If the true splenic fever, this must be misreported, and must refer to native cattle, "among cattle brought from more southern latitudes." In Knox County, Tennessee, this disease prevailed mainly among milch cows exposed to contact with Texas cattle at a point where they were fed, in their passage to Virginia. The reporter for Lincoln County, Kentucky, states that in February, 1871, thirty-five Texas cattle were pastured with native stock. In July, the latter began to sicken of Texas fever, and about twenty died. The Texans fattened and did well. In Logan County, Illinois, seventy-five Texas cattle were placed in pasture with two hundred natives, mostly three-year-old steers; thirty-four head of the latter died of the fever. A drove

in Cass County lost seven that had contracted the disease by being shipped from Kansas in cars in which Texas cattle had been carried. In Scott County several deaths from "Spanish fever" are reported. In Taney County, Missouri, twelve animals were attacked with splenic fever; only one recovered. The disease has existed in Kansas more than elsewhere, on account of exposure to cattle from Texas. In the northeastern part of Sedgwick County, where Texas cattle were pastured to the utmost capacity of the "range," many of the native cattle died. In other portions of the county, in which Texas cattle also ranged, the loss was small. Only native cattle were attacked, the improved breeds suffering most, and the scrubs least. In the southern part of Neosho, where Texas cattle were pastured, native cattle took the disease merely by crossing the track of the Texas. In Morris the loss by splenic fever was 25 per cent.; some farmers lost all their native stock. The loss in Marion is estimated at 100 per cent. The loss in Lyons is placed at 5 per cent.; in Montgomery, 10 per cent., but no case occurred among cattle in inclosures; in Allen one hundred head; in Labette, where the stringent law against the movement of Texas cattle was evaded by driving across the border at night, many cattle in the vicinity of their trail were attacked, and three-fourths of the number died. In Dickinson and Washington several cases occurred. A drove of Texans passed through the southeastern part of Woodson in August, and in about two weeks the disease broke out among the native cattle with fatal effect. The following is an account of the breaking out of this disease in a high latitude:

Fort Randall, Todd County, Dakota.—An outbreak of "splenic or periodic fever" among beef-cattle, (about two hundred head,) at this post, commenced in May, 1871, when ten deaths occurred; in June, six; in July, ten; in August, twenty-two; and in September, three. The epidemic reached its acme about the middle of July. The total number of deaths, in two hundred head of cattle, was fifty-one. Mode of invasion, rapidity of course of disease, and death occurring at an early period, together with *post-mortem* appearances, prove conclusively that it was "splenic fever," the affection described by Professor John Gamgee, in report of the Agricultural Department. It is highly probable that the cattle arriving here in two different lots have had the disease communicated to them by passing over, or having been herded in, sections of country previously traveled over by droves of Texas cattle *en route* to supply the various Indian agencies along the Missouri River.

The disease is reported by correspondents in Benton, Prairie, and Independence Counties, Arkansas.

Independence County, Arkansas.—Spanish fever has not been seen for three years past—that is, since the law was passed prohibiting the passage of Texas cattle through the State—until last June, when five wagons from Texas, drawn by twenty yoke of oxen, passed northward on one of our principal roads, camping a day or two in a place, and their cattle allowed to graze near the road; and, strange as it may seem, fever attacked our own cattle at each of these camping places within this county, and probably one hundred of these cases proved fatal. Those in pastures, having no access to these places, were not attacked. The infection seemed to lose its influence in about thirty days after the passage of the Texas oxen. I am not able to give the actual loss in this county at that time. It was probably between one hundred and one hundred and fifty head.

Several cases are reported in Nemaha, Nebraska; and heavy losses in Santa Clara, California, are imputed to splenic fever, but the facts are not sufficient to identify the disease.

Pleuro-pneumonia.—A dozen cases of this disease have occurred in Ocean County, New Jersey. It was treated by bleeding, blistering, the use of carbolic acid about the stalls, of aperients, and diaphoretics. In Burlington County the county agricultural society, at its annual meeting, appointed a committee to urge the State legislature to devise measures for the extermination of the disease, which had a foot-hold in

that vicinity. In the northern part of the county three cows and a bull, in a herd of twelve, were attacked in September, and died. No cattle had been introduced into the herd for a year previous. Two other herds in the same locality were attacked in December and suffered till March, with a loss of eight head. One calf died at six weeks old, although the mother showed no signs of the disease. Not a single animal recovered which showed positive symptoms of the disease. On fifteen farms in Camden the aggregate loss from this disease is placed at one hundred and twenty head. Pleuro-pneumonia has prevailed to considerable extent in Baltimore County, Maryland, principally in the vicinity of Baltimore City, the heaviest losses generally occurring where the cows were kept in close, filthy stables. Experience has shown that cleanliness and thorough ventilation have great effect in checking the disease. There are still some cases, and it is proposed, if it does not soon abate, to try inoculation, which is claimed to be safe and reliable. It has also prevailed to some extent on several farms near Chadd's Ford, Pennsylvania, with a few isolated cases in other parts of the county.

Abortion has not been so prevalent as to be especially referred to, except in Oneida County, New York, where 5 per cent. of the calves were lost, occurring mostly where the cows were weakened by being milked late in the winter; in Otsego, where a few cases occurred; in Chenango, many cases, the loss to the farmer in each being from $15 to $25; in Litchfield, Connecticut; in Essex and Sussex, New Jersey. In Mercer, Pennsylvania, a fever and inflammation of the womb has prevailed among cows soon after calving, which has generally proved fatal unless prompt attention is given.

"*Black-Leg*" is reported in many places in different portions of the country. No remedy is reported as efficient. In Coryell, Texas, many deaths of cattle were caused by the "heel-fly," which resembles the bot-fly, and is a great annoyance, driving the cattle into the water and into the thickets where they cannot graze. It appeared about January 1.

Various diseases.—Our correspondent in Kent, Michigan, thus describes a prevalent disease:

A cattle-disease commenced last fall east of Ionia, extending on the north of Grand River, westward to Plainfield, and thence south over a belt of country. It attacked cattle of all ages and conditions, but especially young cows. It affected the fourth stomach, duodenum, liver, gall, bladder, and circulating system. The pathology of the disease showed, upon dissection, a putredinous formation, and a discharge of bile into the duodenum from the pale ash-colored, macerated liver. The predisposing causes of the disease are various. The diseased bile from the liver is evidently the reason of the putrid contents of the duodenum, but whether this springs from smut on corn is another question. A cow which sickened and died within an hour had been fed daily for two years with a pailful of kitchen swill and two pailfuls of bran, with such coarse food as she could pick up from various dung-hills. The course of the disease is rapid, generally from half an hour to two hours. The animals are uneasy, stepping about, striking their hind legs against the abdomen, lying uneasily upon the ground, groaning, feeble pulsation of arteries, heart-action reduced, breathing somewhat quickened, the mucous coat of the mouth and eyes looks pale and bluish, paunch mostly full of food, but not distended with gas, nose and extremities cold. A *post-mortem* examination shows that muscular and nervous systems are in a normal condition, and that all the organs within the thoracic and abdominal cavities are healthy, except the liver, the gall-bladder, the duodenum, and the pyloric portion of the abdomasum, which shows no signs of congestion or inflammation, but is bloodless and colorless. The serous coating is of a pale-bluish hue; the muscular coat of the duodenum a darker hue; the softened mucous coat of a darker violet. The gruel-like contents of the duodenum, from the point where the biliary and pancreatic ducts discharge their fluids into it, are of a pale or greenish-black color, diffusing an intensely penetrating foul smell. The coating of the liver is of a pale-tan color, and its substance soft. The gall-bladder is of a pale green. The mesentery, stomachs, and digestive canal on either side, from the pyloric portion of the abdomasum and duodenum, are bloodless and pale. The blood is black, insufficient in fibrine. These facts all indicate

that the disease consists of a peculiar disorder of the liver, caused by a diseased state of the blood; the bile secreted from the same in turn disorders the digestive function and produces an unhealthy gastric juice. No treatment has been found effective. To a certain degree the disease may be prevented by avoiding all smutty, rusty, musty, or over-ripened corn, and by feeding roots always seasoned with a little salt, with an abundance but not an overplus of pure, clear water.

In Bedford, Tennessee, several deaths are attributed to the same cause. In Washington, Kansas, disease, attributed to eating smutty stalks, has been fatal in few cases.

Our correspondent in Orange County, Florida, refers to the prevalence of "salt-sick," attributing it to the deficiency of phosphates in the grass. A similar report comes from Levy County, Florida. Cattle began to look badly in September, after the wet season and high water of August, and nearly one-third have since died.

"Black-tongue" has been very fatal in Suwanee, Florida, destroying from one-tenth to one-half of several herds, while others were entirely exempt. "The throat swells at the root of the tongue, as in horse-distemper, and prevents the animal from eating." The same disease has prevailed in Worth County, Georgia, where the loss has been greater than the natural increase. "The symptoms are stiffness in the legs, turning around and staggering, slavering, tongue black and coated, unable to eat."

The following extracts from correspondence give accounts of several nameless, misnamed, or unknown diseases:

James City, Virginia.—Several cows have been singularly affected this winter: two milch cows with weakness of loins and partial loss of use of hind legs, and one with inflammation of eyes, bordering on blindness. These animals appeared well in other respects, and had good appetites. They improved on a change of food from corn to rutabagas.

Lunenburgh, Virginia.—A *post-mortem* examination was made upon some cattle lost last summer from a disease called "distemper." It was found that the first stomach was highly inflamed, and contained considerable quantities of old-field grass, called "broom," (embracing three distinct species of *Andropogon*,) in an undigested state and compacted into hard wads. If these cases were really distemper, the examination showed the immediate cause of death, but did not make it clear whether the digestive organs were deranged, or the substance entirely indigestible.

Stokes, North Carolina.—A fever called distemper or murrain has carried off many cattle—two-thirds of all attacked—although many farmers profess to be able to cure it. Costiveness and discharge of bloody water usually are symptoms. I have used with success, for many years, as a preventive, a mixture of equal parts of lime and salt placed where the animals had free access to it.

Kendall, Texas.—During last December twenty-six head of cattle died upon three farms from a disease supposed at the time to be hydrophobia. The symptoms were distended nostrils, wild and glassy appearance in the eye, and frothing at the mouth.

Fayette, Tennessee.—Considerable loss from what was called murrain. It commenced during the drought of last fall, and is believed to have been caused by the grass becoming too dry to digest properly, and a plentiful supply of water not accessible. The consequence, obstruction, followed by death. There have been no cases where farmers have been careful to keep their cattle loose in the bowels; no remedy where the disease once got a firm hold.

Renville, Minnesota.—Considerable mortality from drinking bad, stagnant water. A mixture of six parts salt, two parts sulphur, and one of saltpeter, has been found valuable.

Meeker, Minnesota.—During some seasons past considerable numbers of cattle have had swellings on the lower jaw, breaking out into thick, ropy discharges for several months. Several deaths have occurred. No name nor cure for this disease has been found.

From Mr. Roger Conant we have the printed report of a committee appointed to investigate the causes of a new disease which has been prevailing to a considerable extent among the cattle in the vicinity of Santa Cruz, Santa Cruz County, California. From this report we learn that the first symptom of the disease is a desire to rub some part of

the body, usually the nose, ear, jaw, leg, or side. The animal uses its feet, or any convenient object, such as a tree, fence, or post, to rub against. The itching seems allayed somewhat by the friction, but soon returns with increased violence, until the hair and skin are quite rubbed and torn off. The parts swell and fill with a serous fluid, as the disease advances. The animal becomes frantic, and dies, apparently from exhaustion, from eight to twenty-four hours after the first symptoms have shown themselves. Sometimes they bloat before death. But little derangement of the secretions is noticeable. There is no fever, and the circulation at first is normal, becoming weaker and more rapid toward the last. Several *post-mortem* examinations of cattle dying of this disease were without satisfactory results, as each case seemed to present different features.

SHEEP.—This class of animals, so liable to disease, have been exempt from prevalent disorders to a far greater degree than for several years past. When of little value they die off by thousands; as they appreciate in the market, disease disappears.

Foot-rot is still found in a few flocks, but its virulence has generally disappeared as obstinate cases have been culled out, and medication and cleanliness have been brought into requisition. In places where it was almost universally prevalent two years ago, it is now scarcely found. It usually yielded readily to applications of white vitriol or a weak solution of corrosive sublimate, in the mild form in which it has appeared during the past year. It has had a slight foot-hold in most of the counties of the Middle States, and has in Yates County, New York, affected 75 per cent. of the flocks; it has been somewhat troublesome in several of the central counties of New Jersey; in Washington, Pennsylvania, it was confined to merinoes; in Galveston County, Texas, losses from this cause amounted to 10 per cent.; it has had slight existence in the Southern States, with the exception of Texas; in Medina County, Ohio, half the sheep have been affected; in Martin, Indiana, a loss of 20 per cent. is reported; and its occasional prevalence is reported in all the prairie States east of the Missouri River.

Scab.—This disease does not appear to have been prevalent, except in Texas, and in portions of Missouri, though a few cases are reported in Massachusetts, New York, Illinois, and other States.

Rot.—The reports of "rot" are not always accompanied with statements of symptoms showing the characteristics of the disease. From several of the Southern States "rot" is reported. In Clackamas County, Oregon, severe losses resulted from what is locally designated "leech in the liver," the liver being infested with parasites.

Various other diseases appear in isolated cases, of which "grub in the head" was most common. A disease in Barton County, Missouri, carried off a large proportion, scarcely five hundred being left, though large flocks have since been brought in. Losses were reported in the South from eating acorns. In Houston, Minnesota, a skin-disease commences with a few pimples under the fore-leg where no wool grows, which extend rapidly, the skin becoming raw over the uncovered portions of the body, the ulcers emitting a bad odor.

SWINE.—The mortality of swine is quite too common to report in detail. The losses by what is called "hog-cholera," which is practically any prevalent fatal disease, are most common in the West and South, ranging from 5 to 50 per cent. of the entire number in any county; and in severely infected districts, smaller than counties, a loss of from 60 to 75 per cent. is not an unfrequent record. A distiller in Switzerland County, Indiana, lost hogs valued at $10,000. It is generally reported

that hogs in confinement are the ones attacked, and instances of recovery have occurred when they are allowed free range. It is frequently stated that these losses are a great discouragement to swine-raising. The business has been nearly broken up by this cause in Jefferson County, Tennessee, the stock of hogs being less than five thousand, while the numbers some years ago reached seventy thousand. In many places the loss of young pigs reaches 20 to 30 per cent.; in other instances the greatest mortality is among swine of fifty to one hundred pounds; while in others, still, fat hogs are swept off in great numbers. The usual list of remedies is given, which comprises in substance the entire inventory of an apothecary shop. Prevention is what is wanted; and it must be sought in a better knowledge of the conditions of health, and greater care to secure it.

PRICES OF FARM-ANIMALS.

In February of each year from 1866 to 1872, and in January of the present year, an investigation of the current home prices of farm-animals has been made through the statistical correspondents of this division, whose estimates have been prepared with the assistance of county assessors and farmers of reliable judgment. They are not based upon valuation for purposes of taxation, (which valuation is notoriously an under-valuation, representing one-third, one-half, or possibly two-thirds of the real value,) but are founded upon the actual cash value in the transactions of local markets. A study of these returns, and of their fair expression in an average for each State, with the local circumstances calculated to affect values, will satisfy the candid statistical inquirer that they furnish internal evidence of substantial correctness, at least far more reliable than any returns of assessors' valuations, which would require a different interpretation in each of the several States.

During this period the prices of horses ruled highest in February, 1869. Mules were also highest at the same period, but somewhat higher in the beginning of 1870, at the time when plowing commenced for the great crop of cotton of that year. "Oxen and other cattle" were at their maximum in 1869, and cows averaged $39.11 at the same date, but were held at $39.12 in the beginning of 1870, when cows were in special demand for the extension of cheese-making, though the average for other cattle was that year reduced to $22.54. Sheep, in their decline from war prices, reached their lowest average, $2.17, in February, 1869, showing a small increase in 1870, a jump from $2.32 to $2.80 between 1871 and 1872, and a further increase in January, 1873, to $2.96. The following table gives the averages obtained by dividing the aggregate valuation of each class by the total number, the date referring to the time of the investigation—February of each year to 1872, inclusive, and January of 1873:

	1873.	1872.	1871.	1870.	1869.	1868.
Horses	$74 36	$73 37	$78 51	$81 38	$84 16	$75 16
Mules	95 24	94 82	101 52	109 01	106 74	77 61
Oxen and other cattle	20 06	19 61	22 81	22 54	25 12	20 86
Milch cows	29 62	31 97	37 33	39 12	39 11	36 78
Sheep	2 96	2 80	2 32	2 28	2 17	2 52
Swine	4 09	4 36	6 19	6 99	6 26	4 55

The period of maximum value of swine was that following the small corn-crop of 1869, when the average home value of corn in Illinois was 57 cents, it having been but 43 the previous year, and 35 in the January following.

HORSES.—A decline in horses during 1871 was reported in nearly all the States. Texas was mentioned as an exception. The reduction was less marked in the Western than in the Eastern States. The investigation of January, 1873, shows that the advance is still progressing in Texas; that higher prices rule in several of the Southern States; that in the central or interior States there has been no material change in values during 1872.

The highest prices returned are those of New Jersey; the lowest, those of Texas. The average price of all horses, of all ages, in New Jersey is estimated at $127.21, $108.26 in Massachusetts, $104.80 in Georgia, $102.58 in New York, $100.82 in South Carolina, $100.79 in Louisiana, $100.30 in Rhode Island. In all other States it is less than $100, running down to $37.41 in Texas, where are bred large numbers of mustang or Mexican horses. Year after year the due proportion between the rates of different sections and those named for the various ages of animals is mentioned in the returns, with only such changes as are attributable to assigned or manifest causes, affording evidence in these local estimates of their approximate correctness.

In Maine prices of horses have shared in the general appreciation of values of domestic animals from the returns of comparative abundance of feeding-material. In Massachusetts and New Jersey, where prices have ruled high, the late returns indicate a smaller average than last year; and in New York and Pennsylvania the average is somewhat higher than was returned last year. The comparison in New York is as follows:

Date.	One year.	Two years.	Three years.	Over three years.
1872, February	$40 49	$67 41	$94 58	$130 58
1873, January	42 00	69 50	99 00	135 00

A small decline appears in Delaware and Maryland. A slight advance is shown in Virginia, and, in horses of full age, in North Carolina. The rate for horses of three years and upward in Georgia has advanced from $113.29 to $123; in Mississippi, from $110 to $111.21; and in Texas the comparison is as follows:

Date.	One year.	Two years.	Three years.	Over three years.
1872, February	$12 43	$18 72	$30 08	$46 23
1873, January	15 32	22 48	32 92	51 29

A slight advance is seen in Arkansas, and a decline in Tennessee from $105.27 to $101.20; from $93.15 to $88.25 in West Virginia; and from $89.67 to $87.66 in Kentucky. The change is slight in Ohio, Indiana, and Illinois. Former high rates in Michigan are not fully sustained. Young stock in Minnesota shows little change, while prices of full-grown animals have advanced; an increase is also made in Wisconsin. A slight tendency to retrograde is seen in Iowa:

Date.	One year.	Two years.	Three years.	Over three years.
1872, February	$27 27	$41 35	$59 47	$95 02
1873, January	27 91	42 50	61 73	88 00

The highest class in Missouri has declined from $74.15 to $72.35; in Kansas from $84.26 to $76.59. In Nebraska the prices of young horses

sympathize with the prevalent low rates of farm products, but full-grown horses, in great demand for service in enlarging the cultivated area, bring higher prices than last year. Horses are also higher in California and Oregon.

A comparison with last year, in the States named, for horses of the several ages, will show substantially the differing rates and recent changes in various sections of the country. The rise in New Jersey shows that depreciation is not uniform in the Northern Atlantic States:

States.	1873.				1872.			
	One year.	Two years.	Three years.	Four years.	One year.	Two years.	Three years.	Over three years.
New Jersey	$48 12	$79 50	$112 10	$147 50	$52 30	$82 30	$116 53	$148 57
Georgia	40 90	64 50	90 75	123 00	38 70	61 41	87 36	113 29
Ohio	34 39	53 89	77 00	104 45	33 42	51 82	76 86	102 28
Kentucky	33 00	48 59	62 80	87 66	33 39	49 19	68 00	89 67
Illinois	28 50	42 06	61 64	88 56	28 43	41 83	59 90	88 26
Texas	15 32	22 48	32 92	51 29	12 43	18 72	30 08	46 23

MULES.—The prices of working-mules have advanced throughout the Middle and Southern States, except that the high rates in New Jersey are not sustained, though the average is still higher than in any other State. The average in Texas has advanced from $67.60 to $75.73. Growing mules in Kentucky are held at an advance, while the rate for full-grown is unchanged, at $112.15. A slight advance is seen in Indiana, Illinois, and Minnesota, and a small decline in Wisconsin, Iowa, Missouri, and Kansas. The stock of Nebraska is inadequate to the wants of agriculture, and commands advanced rates.

MILCH COWS.—It was stated, a year ago, that the prices of neat stock were lower than for seven years, except in Texas, where appreciation is resulting from the heavy drain upon the stock-reserves by drovers, until the present year, the rates for which are declining. In 1869 the prices of cows attained their highest limit, since which date the tendency has been downward. There has been an arrest in this movement in some portions of the country. In Maine, New Hampshire, and Vermont, particularly in the first-named State, where cattle were sacrificed last season on account of the partial failure of the hay crop, prices have rallied with the increase of forage. There has been an upward tendency in this kind of stock in the cotton States, which keeps pace with the movements toward improvement in quality and enlargement of the dairy interest. A few examples will show the direction and extent of these changes during the past eight years:

States.	1873.	1872.	1871.	1870.	1869.	1868.	1867.	1866.
Massachusetts	$41 16	$39 87	$59 16	$57 00	$67 50	$67 11	$59 80	$62 00
New York	34 00	39 53	48 51	54 11	54 14	52 54	57 22	54 14
Pennsylvania	35 50	39 16	46 67	46 83	47 11	44 94	47 36	51 18
Ohio	32 18	37 36	45 09	44 77	43 00	43 07	44 94	47 33
Michigan	33 32	36 86	41 15	42 94	44 62	42 30	47 27	43 52
Illinois	30 45	33 77	37 68	37 02	38 11	36 62	35 90	34 84
Iowa	28 16	28 49	34 31	34 91	36 13	31 10	31 35	30 12
Missouri	23 26	25 85	31 92	32 32	31 21	29 04	29 86	32 87
Kansas	28 94	30 77	38 46	37 42	30 67	29 88	32 11	27 94
Tennessee	21 54	22 83	23 57	29 07	28 04	25 08	27 88	....
Georgia	21 93	20 81	21 61	22 48	22 36	21 06	21 64	....
Texas	13 50	14 12	12 83	10 67	9 12	10 29	11 20	....

OXEN AND OTHER CATTLE.—This class includes all neat stock except milch cows. There was a considerable decline, in some sections quite marked, in 1870, partly as a result of the general retrograde from the war prices of preceding years, and partly from the local scarcity of feed. It was less in the South, where rates have ruled low, the breed inferior, and the need of more and better stock is more and more realized. In the West generally prices were lower, except in Wisconsin and Iowa, where cattle are taking their proper place in the farm economy as exclusive wheat-culture becomes unprofitable. It is gratifying to be able to state that the bottom has been reached, according to the hopeful assurance of the last annual report, and that the prices of farm-stock have not continued "to suffer a greater depreciation than that which affects other branches of productive industry." Cattle in Maine are held at advanced rates, from the reason assigned for increase in prices of other stock; and an advance appears, also, in New Hampshire, Vermont, Massachusetts, and Rhode Island. No material change of rates is apparent in New York. In New Jersey prices have declined, and also slightly in Pennsylvania. In Delaware, Maryland, Georgia, Alabama, and Florida, some advance is noted, while in Virginia and South Carolina rates are substantially unchanged, and in North Carolina not fully sustained. The Texas rates are slightly declining, as follows:

Date.	One year.	Two years.	Three years.	Over three years.
February, 1873	$3 10	$4 86	$8 07	$12 52
January, 1872	3 00	4 42	7 56	11 54

So in Arkansas; while in Louisiana and Tennessee there is no material change. The price of cattle three years old and upward has declined in Kentucky from $39.41 to $37.54; in Ohio, from $45.16 to $42.43; in Michigan, from $46,18 to $46; in Wisconsin, from $42.38 to $37.08; in Minnesota, from $38.46 to $36.77. An advance appears in Indiana from $36.53 to $39.06; in Illinois, from $36.40 to $38.83; in Iowa, from $36.16 to $38.83; in Missouri, from $29.72 to $30.15. The younger cattle command a proportionate increase in these States. A comparison of prices (of three years old and upward) in these States is as follows:

Date.	Kentucky.	Ohio.	Michigan.	Indiana.	Illinois.	Iowa.	Kansas.
1872	$39 71	$45 16	$46 18	$36 53	$36 40	$36 16	$31 42
1873	37 54	42 43	46 00	39 06	38 66	38 83	31 13

Taking all the States together, the prices of cattle of all grades are well sustained amid the despondency arising from the low rates of many other productions of the farm. The average for cattle of all ages, in all the States, as found by dividing the grand aggregate of values of "oxen and other cattle" by the total numbers in the country, was in January, 1873, $20.06, instead of $19.61 in the previous annual investigation.

The fluctuations of the past few years, and especially the great reduction in prices from the highest rates obtained since 1866, the first year in which these returns were made for the entire country, will be seen from an examination of the following table, which includes principal States of each section, and gives the prices of cattle of three years old and upward:

Oxen and other cattle over three years old.	1873.	1872.	1871.	1870.	1869.	1868.	1867.	1866.
New York	$52 00	$50 70	$64 57	$71 72	$72 94	$71 54	$68 57	$68 90
Virginia	27 60	27 96	35 51	33 34	33 14	32 64	29 00	....
Georgia	17 55	16 15	17 08	19 00	22 80	18 60	17 16	....
Texas	11 54	12 52	11 78	9 85	8 94	8 56	9 46	....
Tennessee	21 00	21 38	23 50	26 84	26 90	21 06	24 44	....
Ohio	42 43	45 16	53 15	52 37	52 64	51 50	51 03	54 00
Illinois	38 66	36 40	43 00	41 54	46 68	42 07	40 19	36 82
Minnesota	36 77	38 46	39 58	47 06	46 64	51 50	52 68	50 34
Kansas	31 13	31 42	44 07	46 60	40 16	37 08	38 40	42 58

SHEEP.—A continued advance in the price of sheep is reported, almost without exception, although it is small in some of the States. The lowest average is $1.75, in North Carolina and Georgia, and the highest is $5.75, in Rhode Island. The comparison (for sheep one year old) in the following States is thus stated:

Year.	Kentucky.	Ohio.	Michigan.	Indiana.	Illinois.	Iowa.	Missouri.	Kansas.
1872	$2 84	$2 37	$3 14	$2 76	$2 90	$2 88	$2 14	$2 56
1873	3 13	3 32	3 17	3 06	3 60	2 70	2 22	2 72

SWINE.—The decline in the value of hogs is very marked, as will be seen from a comparison of our returns for the past four years in the principal pork-producing States. Something of the difference noted in the average prices of the different States is due to degrees of improvement in quality, and difference in average weight, relative amount of feed, care, &c.

States.	1872.		1871.		1870.		1869.	
	Under 1 year.	Over 1 year.	Under 1 year.	Over 1 year.	Under 1 year.	Over 1 year.	Under 1 year.	Over 1 year.
Kentucky	$2 55	$5 71	$3 65	$8 30	$4 26	$10 88	$4 46	$10 35
Ohio	3 93	9 07	6 20	12 97	6 95	16 76	6 33	15 53
Michigan	3 54	8 06	5 39	13 34	5 27	12 97	5 29	12 40
Indiana	2 98	6 79	4 72	10 01	5 09	12 37	4 91	11 56
Illinois	3 78	7 48	5 79	12 71	6 32	13 65	6 15	15 23
Wisconsin	3 51	7 14	6 28	12 91	6 41	14 35	5 35	13 45
Minnesota	4 04	8 64	5 05	11 29	5 78	12 13	5 54	12 91
Iowa	3 71	7 94	5 28	12 79	6 47	14 90	6 02	14 41
Missouri	2 18	4 78	3 37	7 28	3 53	8 60	2 70	7 03
Kansas	4 27	9 25	6 93	14 73	5 16	12 73	4 95	12 46

Table showing the estimated total number and total value of each kind of live stock, and the average price in January, 1873.

States.	HORSES.			MULES.			OXEN AND OTHER CATTLE.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	78, 000	$89 61	$6, 989, 580				185, 100	$38 64	$7, 152, 264
New Hampshire	47, 500	87 01	4, 132, 975				118, 100	38 41	4, 536, 221
Vermont	71, 000	93 29	6, 623, 590				130, 700	38 62	5, 047, 634
Massachusetts	101, 800	108 26	11, 020, 868				121, 400	39 86	4, 839, 004
Rhode Island	14, 700	100 30	1, 474, 410				16, 900	52 72	890, 968
Connecticut	50, 300	98 89	4, 974, 167				111, 200	40 66	4, 521, 392
New York	659, 300	102 58	67, 630, 994	19, 100	$130 06	$2, 484, 146	704, 800	34 05	23, 998, 440
New Jersey	115, 700	127 21	14, 718, 197	14, 900	144 81	2, 157, 669	84, 800	32 43	2, 750, 064
Pennsylvania	546, 100	102 46	55, 953, 406	24, 900	128 32	3, 195, 168	715, 500	30 13	21, 558, 015
Delaware	20, 000	90 41	1, 808, 200	4, 000	115 31	461, 240	33, 400	28 84	963, 256
Maryland	104, 500	88 91	9, 291, 095	10, 900	124 62	1, 358, 358	125, 600	23 66	2, 971, 696
Virginia	185, 600	81 57	15, 139, 392	29, 400	109 30	3, 213, 420	405, 700	16 87	6, 844, 159
North Carolina	131, 800	90 13	11, 879, 134	47, 500	112 02	5, 320, 950	316, 500	9 81	3, 104, 865
South Carolina	55, 300	100 82	5, 575, 346	45, 200	112 25	5, 073, 700	179, 600	13 93	2, 501, 828
Georgia	117, 300	104 80	12, 293, 040	92, 700	126 59	11, 734, 893	401, 300	10 99	4, 410, 287
Florida	16, 800	95 99	1, 612, 632	10, 400	127 05	1, 321, 320	383, 600	8 93	3, 425, 548
Alabama	107, 700	92 22	9, 932, 094	103, 600	102 08	10, 575, 488	344, 500	13 07	4, 502, 615
Mississippi	87, 500	93 85	8, 211, 875	99, 100	113 81	11, 278, 571	336, 600	12 70	4, 274, 820
Louisiana	75, 000	100 79	7, 559, 250	76, 200	121 59	9, 265, 158	181, 200	12 38	2, 243, 256
Texas	672, 300	37 41	25, 150, 743	92, 200	56 50	5, 209, 300	2, 842, 200	7 51	21, 344, 922
Arkansas	160, 900	78 38	12, 611, 342	82, 800	94 88	7, 856, 064	251, 600	11 77	2, 961, 332
Tennessee	294, 100	79 88	23, 492, 708	100, 200	93 27	9, 345, 654	351, 600	13 67	4, 806, 372
West Virginia	103, 600	66 90	6, 930, 840	2, 300	84 27	193, 821	235, 500	24 66	5, 807, 430
Kentucky	343, 900	67 88	23, 343, 932	84, 500	77 98	6, 589, 310	384, 300	24 02	9, 230, 886
Ohio	738, 600	79 76	58, 910, 736	22, 600	82 37	1, 861, 562	901, 000	27 71	24, 966, 710
Michigan	282, 700	80 40	22, 729, 080	4, 000	90 83	363, 320	463, 500	28 27	13, 103, 145
Indiana	669, 600	67 78	45, 385, 488	35, 600	72 58	2, 583, 848	765, 000	23 98	18, 344, 700
Illinois	1, 049, 400	66 31	69, 585, 714	98, 800	78 73	7, 778, 524	1, 260, 900	23 89	30, 122, 901
Wisconsin	335, 300	77 66	26, 039, 398	5, 000	100 86	504, 300	440, 400	23 63	10, 406, 652
Minnesota	142, 300	78 82	11, 216, 086	3, 000	88 73	266, 190	269, 300	21 44	5, 773, 792
Iowa	634, 400	63 85	40, 506, 440	36, 400	72 93	2, 654, 652	820, 000	23 41	19, 196, 200
Missouri	527, 200	51 49	27, 145, 528	89, 200	70 96	6, 329, 632	782, 900	18 30	14, 327, 070
Kansas	198, 900	53 10	10, 561, 590	17, 400	68 07	1, 184, 418	457, 000	20 46	9, 350, 220
Nebraska	47, 700	73 14	3, 488, 778	4, 100	103 89	425, 949	73, 260	25 14	1, 840, 248
California	250, 000	44 15	11, 037, 500	25, 000	71 06	1, 776, 500	442, 200	22 71	10, 042, 362
Oregon	80, 800	50 73	4, 098, 984	4, 000	50 49	201, 960	116, 700	19 43	2, 267, 481
Nevada	9, 870	47 50	468, 825	1, 000	65 00	65, 000	40, 000	23 00	920, 000
The Territories	95, 000	52 00	4, 940, 000	24, 000	84 50	2, 028, 000	620, 000	22 50	13, 950, 000
Total	9, 222, 470		684, 463, 957	1, 310, 000		124, 658, 085	16, 413, 800		329, 298, 755
Grand average of prices		74 21			95 15			20 06	

Table showing the estimated total number and total value of each kind of live stock, and the average price in January, 1873—Continued.

States.	Milch cows.			Sheep.			Hogs.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	147,600	$36 56	$5,396,256	413,800	$4 29	$1,775,202	62,700	$9 90	$620,730
New Hampshire	90,000	36 00	3,240,000	230,800	4 23	976,284	42,000	11 75	493,500
Vermont	195,700	35 33	6,914,081	604,000	4 03	2,434,120	58,200	9 56	556,392
Massachusetts	139,100	41 16	5,725,356	74,900	3 87	289,863	80,500	13 47	1,084,335
Rhode Island	20,700	42 50	879,750	27,900	5 36	149,544	18,100	12 00	217,200
Connecticut	106,800	39 50	4,218,600	83,200	4 93	410,176	63,700	13 13	836,381
New York	1,439,400	34 00	48,939,600	2,100,300	4 30	9,031,290	671,700	8 31	5,581,827
New Jersey	147,900	44 16	6,531,264	125,900	4 96	624,464	164,700	9 25	1,523,475
Pennsylvania	796,700	35 50	28,282,850	1,691,000	3 68	6,222,880	1,088,900	8 12	8,841,868
Delaware	26,000	33 00	858,000	27,300	4 12	112,476	47,300	5 75	271,975
Maryland	96,900	30 77	2,981,613	129,400	4 17	539,598	264,200	6 30	1,664,460
Virginia	234,000	23 69	5,543,460	386,900	3 04	1,176,176	818,600	3 67	3,004,262
North Carolina	201,200	17 00	3,420,400	293,200	1 61	472,052	848,800	3 08	2,614,304
South Carolina	154,800	25 50	3,947,400	155,000	2 05	317,750	332,600	4 66	1,549,916
Georgia	257,400	21 93	5,644,782	253,500	1 62	410,670	1,559,400	3 00	4,678,200
Florida	71,900	15 11	1,086,409	32,900	2 03	66,787	181,600	2 70	490,320
Alabama	177,000	19 85	3,513,450	186,200	1 93	359,366	961,300	3 10	2,980,030
Mississippi	180,100	23 12	4,163,912	167,000	1 85	308,950	890,400	2 98	2,653,392
Louisiana	93,600	26 50	2,480,400	73,500	2 00	147,000	290,800	3 93	1,142,844
Texas	566,200	13 50	7,643,700	1,239,600	1 80	2,231,280	1,233,800	2 90	3,578,020
Arkansas	150,300	20 43	3,070,629	160,300	2 19	351,057	1,067,300	2 58	2,753,634
Tennessee	247,700	21 54	5,335,458	372,400	1 93	718,732	1,596,600	3 38	5,396,508
West Virginia	120,700	29 80	3,596,860	561,600	2 67	1,499,472	351,600	3 58	1,258,728
Kentucky	229,400	30 13	6,911,822	824,600	2 89	2,383,094	2,113,700	3 19	6,742,703
Ohio	786,400	32 18	25,306,352	4,639,000	3 02	14,009,780	2,217,000	4 57	10,131,690
Michigan	350,600	33 32	11,681,992	3,418,000	2 89	9,878,020	543,500	4 52	2,456,620
Indiana	453,000	30 73	13,920,690	1,913,900	2 83	5,416,337	2,713,900	3 61	9,797,179
Illinois	710,900	30 45	21,646,905	1,394,300	3 20	4,461,760	3,706,300	4 30	15,937,090
Wisconsin	425,700	28 00	11,919,600	1,153,100	2 83	3,263,273	658,400	4 67	3,074,728
Minnesota	182,400	30 08	5,486,592	151,400	3 08	466,312	209,600	5 03	1,054,288
Iowa	537,300	28 16	15,130,368	1,768,000	2 42	4,278,560	3,847,700	4 47	17,199,219
Missouri	405,200	23 26	9,424,952	1,437,300	2 05	2,946,465	2,656,500	2 40	6,375,600
Kansas	214,000	28 94	6,193,160	123,000	2 45	301,350	457,200	5 30	2,423,160
Nebraska	45,800	30 96	1,417,968	36,600	2 81	102,846	121,300	5 51	668,363
California	270,000	43 44	11,728,800	4,002,800	2 97	11,888,316	427,300	6 11	2,610,803
Oregon	70,000	32 95	2,306,500	534,800	2 76	1,476,048	163,100	4 16	678,496
Nevada	8,500	39 00	331,500	15,000	3 00	45,000	4,750	7 50	35,625
The Territories	225,000	33 50	7,537,500	2,200,000	2 90	6,380,000	97,000	7 75	751,750
Total	10,575,900	....	314,358,931	33,002,400	....	97,922,350	32,632,050	....	133,729,615
Grand average of prices	....	29 72	....	....	2 96	....	....	4 09	....

THE FORESTS OF THE UNITED STATES.

There has of late been expressed so much apprehension of the ultimate destruction of our forests, and of a great scarcity of timber at no distant day, that a statistical examination of the subject may prove neither unimportant nor uninteresting. Fortunately, data presumed to approximate completeness are furnished by the census of 1870. This enumeration includes only farm-lands, leaving untouched the wild or unoccupied tracts of the old States, and all the lands in the new States still owned by the Government. The wild lands of the old States would tend to increase the proportion of forest-lands of the entire country, while the public or unsold lands, so generally treeless, would tend to diminish the grand percentage of area in woodland. The percentage deduced from the census-returns, which include only the area in farms, is 39. If the total area of the country is included, the percentage will be diminished to about 25 per cent. In 1866, before any enumeration of the forest-lands was ever made, the following statement concerning the forest-lands in the United States appeared in the monthly report:

> The proportionate area of forests to the total area of the United States must be somewhat more than that of Russia. Exclusive of the great plains, the western prairies, the forestless portions of oak-openings, the glades of the Alleghanies, the lakes, and the cultivated area of the United States, the forests are reduced quite as much as is compatible with true public economy and safe and healthful climatic conditions. West of the Mississippi the scarcity of forests depreciates by unnumbered millions the value of that vast area. East of that river and north of 38° the forest areas cannot be materially curtailed without serious risk, some portions requiring new forest-plantations, and others admitting of judicious thinning or clearing. In the South, which is nearly covered with forests, some diminution of the forest area is admissible, while indiscriminate clearing might occasion radical changes in climate and production, more destructive in their character than the same decrease of forests in higher latitudes. Estimating the forest area in the United States at 33 per cent., and our population at 35,000,000, the number of acres per head would be eighteen, thus exceeding every European country except Norway.

This hasty jump at an estimate—a leap almost wholly in the dark—proves too high, if the immense treeless areas of the Territories are included, while it is too low for the States exclusive of the Territories. The proportion of forest in our entire area is, therefore, exceeded by that of Russia, as well as of Norway and Sweden, and the proportion of Germany may also slightly exceed that of this country.

The following statement of the proportions of land in forests in the different countries of Europe is made on the authority of the German writer, Reutzsch:

Countries.	Per cent.	Acres per head of pop.
Norway	66.0	24.61
Sweden	60.0	8.55
Russia	30.90	4.28
Germany	26.58	0.6638
Belgium	18.52	0.186
France	16.79	0.3766
Switzerland	15.0	0.396
Sardinia	12.29	0.223
Naples	9.43	0.138
Holland	7.10	0.12
Spain	5.52	0.291
Denmark	5.50	0.22
Great Britain	5.0	0.1
Portugal	4.40	0.182

The accompanying diagram will illustrate the proportion of forest area of farm-lands in the several States, the figures in the white portion of the squares representing the farm area in acres, and those in the shaded portion the proportion of that area in forest, in each State respectively. In some of the States the farm-lands comprise nearly the entire area, exclusive of lakes and streams; in others, those more recently settled, and also some of the original thirteen, the unoccupied or wild lands constitute a considerable proportion of the whole area. Thus Maine has 5,835,058 acres in farms, while her area includes 22,400,000 acres of land and water. In the table following, an estimate of the forest area, outside of that belonging to farms, is added to the total acreage of farm woodlands, to make the estimated total area in forest. In estimating the proportion in woodland, the amount of water in lakes and streams, of prairie, and of ledges and other wastes incapable of producing trees, must be taken into consideration. After canvassing the facts affecting this proportion in the several States, of the area exclusive of farms, one-half was assumed to be in forest in Maine, New Hampshire, Vermont, Pennsylvania, Maryland, Virginia, Florida, Arkansas, Tennessee, and West Virginia; six-tenths were taken for North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana; one-third was taken for Massachusetts, New York, New Jersey, Kentucky, Michigan, and Missouri; one-fourth for Texas and Oregon; one-sixth for Wisconsin and Minnesota; one-eighth for Iowa; one-tenth for Rhode Island, Connecticut, Ohio, Indiana, and Illinois; one-twelfth for California; one-twentieth for Kansas, Nebraska, and Nevada. The proportion assumed respectively for the Territories is: Washington, 33 per cent.; Montana, 16; Idaho, 15; Utah, 10; Wyoming and Indian, 8; New Mexico and Arizona, 6; Dakota, 3. The result of adding this outside forest to that of the farm-lands is given in the following table, which shows the percentage of forest area of States and Territories (second column) in comparison with the census percentage, which includes only the official enumeration of farms:

States.	Percentage in farms.	Total percentage.	States.	Percentage in farms.	Total percentage.
Maine	38.1	46.9	Indiana	39.6	34.8
New Hampshire	29	37.2	Illinois	19.6	16.9
Vermont	30.6	36.5	Wisconsin	29.3	20.9
Massachusetts	25.8	29.2	Minnesota	20.6	17.1
Rhode Island	33.7	24.2	Iowa	16.2	14.1
Connecticut	24.4	21.2	Missouri	41.3	37.4
New York	25.5	27.6	Kansas	11.2	5.6
New Jersey	24	28.1	Nebraska	10.2	5.2
Pennsylvania	31.9	38.9	California	4.1	7.9
Delaware	28	29.2	Oregon	31.8	25.2
Maryland	31.8	38.4	Nevada	6.4	5
Virginia	45.7	46.8			
North Carolina	60.6	60.3	TERRITORIES.		
South Carolina	53.2	56.2			
Georgia	54.6	56.6			
Florida	60	50.6	Colorado	3.5	9.9
Alabama	56	58.1	Utah	0.1	9.9
Mississippi	60.6	60.2	New Mexico	12.7	6
Louisiana	56.9	59.1	Washington	44.8	33.1
Texas	41.6	26.7	Dakota	7.4	3
Arkansas	51.4	50.3	Montana	0.8	15.9
Tennessee	55	53.3	Idaho	9.6	14.9
West Virginia	51.1	50.6	Arizona	......	5.9
Kentucky	48.9	45.4	Wyoming	0.8	7.9
Ohio	31.7	28.4	Indian	....	7.9
Michigan	40.7	35.3	Alaska	....	30

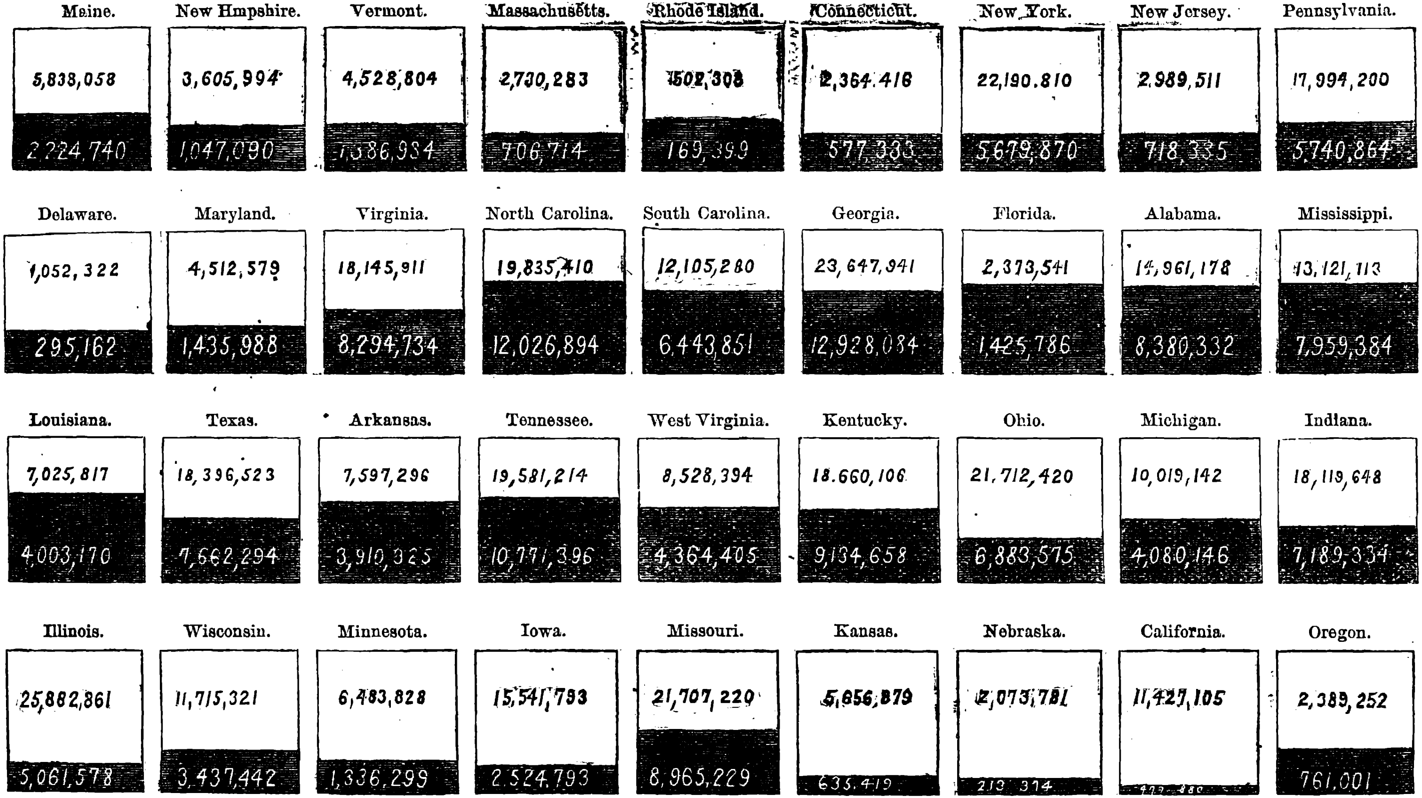


Diagram showing proportion of farm-land areas in forest.

The census percentage is increased in some States, and diminished in others, according to circumstances. In Maine scarcely more than one-fourth of the area is in farms; the remaining land being covered, generally, with forest growths, though culled of valuable timber, increases the census percentage from 38.1 to 46.9, and the increase would be much greater (than the estimated proportion of one-half) but for the remarkable extent of water-surface in addition to barren ledges and other wastes. Rhode Island, on the contrary, has 502,308 acres in farms, of its 835,840—so large a proportion of the whole that nine-tenths of the remainder, 333,532 acres, are assumed to be water, rock, roads, &c., thus reducing the percentage of total area in forest from 33.7 to 24.2. New York has nearly two-thirds of its area in farms, and so much water throughout the State, especially the lakes of the western and northern sections, that only one-third of its 7,889,190 acres in farms is assumed to be in forest. Florida, though having less than one-tenth of its area in farms, has so large a proportion of water area that it is not deemed safe to estimate more than half the unoccupied surface in woods, which reduces the census percentage 60 to 50.6. Ohio has its available area nearly all occupied by farms, and its percentage is therefore reduced from 31.7 to 28.4. The amended percentage, if the estimates are accurate, must be the true proportion for the entire State, and it is undoubtedly nearer the actual percentage than the figures representing only farm-lands.

The following table presents a statement of the area in farms, that outside of farms, the total area, and the forest acreage in farms alone and in the entire area of each State and Territory:

States and Territories.	No. acres in farms.	No. acres not in farms.	No. acres in total area.	No. acres of woodland in farms.	Estimated total area in woodland.
STATES.					
Maine	5, 838, 058	16, 561, 942	22, 400, 000	2, 224, 740	10, 505, 711
New Hampshire	3, 605, 994	2, 333, 206	5, 939, 200	1, 047, 090	2, 213, 693
Vermont	4, 528, 804	2, 006, 876	6, 535, 680	1, 386, 934	2, 390, 372
Massachusetts	2, 730, 283	2, 261, 717	4, 992, 000	706, 714	1, 460, 619
Rhode Island	502, 308	333, 532	835, 840	169, 399	202, 752
Connecticut	2, 364, 416	675, 584	3, 040, 000	577, 333	644, 891
New York	22, 190, 810	7, 889, 190	30, 080, 000	5, 679, 870	8, 309, 600
New Jersey	2, 989, 511	2, 335, 289	5, 324, 800	718, 335	1, 496, 764
Pennsylvania	17, 994, 200	11, 445, 800	29, 440, 000	5, 740, 864	11, 463, 764
Delaware	1, 052, 322	304, 478	1, 356, 800	295, 162	396, 654
Maryland	4, 512, 579	2, 606, 781	7, 119, 360	1, 435, 988	2, 739, 378
Virginia	18, 145, 911	6, 399, 369	24, 545, 280	8, 294, 734	11, 494, 418
North Carolina	19, 835, 410	12, 615, 150	32, 450, 560	12, 026, 894	19, 595, 984
South Carolina	12, 105, 280	9, 654, 720	21, 760, 000	6, 443, 851	12, 236, 683
Georgia	23, 647, 941	13, 472, 059	37, 120, 000	12, 928, 084	21, 011, 319
Florida	2, 373, 541	35, 557, 979	37, 931, 520	1, 425, 786	19, 204, 775
Alabama	14, 961, 178	17, 500, 902	32, 462, 080	8, 380, 332	18, 880, 873
Mississippi	13, 121, 113	17, 058, 727	30, 179, 840	7, 959, 384	18, 194, 620
Louisiana	7, 025, 817	19, 435, 623	26, 461, 440	4, 003, 170	15, 664, 543
Texas	18, 396, 523	157, 191, 317	175, 587, 840	7, 662, 294	46, 960, 123
Arkansas	7, 597, 296	25, 809, 424	33, 406, 720	3, 910, 325	16, 815, 037
Tennessee	19, 581, 214	9, 602, 786	29, 184, 000	10, 771, 396	15, 572, 789
West Virginia	8, 528, 394	6, 191, 606	14, 720, 000	4, 364, 405	7, 460, 208
Kentucky	18, 660, 106	5, 455, 094	24, 115, 200	9, 134, 658	10, 953, 022
Ohio	21, 712, 420	3, 864, 540	25, 576, 960	6, 883, 575	7, 270, 029
Michigan	10, 019, 142	26, 109, 498	36, 128, 640	4, 080, 146	12, 783, 312
Indiana	18, 119, 648	3, 518, 112	21, 637, 760	7, 189, 334	7, 541, 145
Illinois	25, 882, 861	9, 579, 539	35, 462, 400	5, 061, 578	6, 019, 531
Wisconsin	11, 715, 321	22, 796, 039	34, 511, 360	3, 437, 442	7, 236, 781
Minnesota	6, 483, 828	46, 976, 012	53, 459, 840	1, 336, 299	9, 165, 634
Iowa	15, 541, 793	19, 687, 007	35, 228, 800	2, 524, 793	4, 985, 668
Missouri	21, 707, 220	20, 116, 780	41, 824, 000	8, 965, 229	15, 670, 822
Kansas	5, 656, 879	46, 386, 641	52, 043, 520	635, 419	2, 954, 751
Nebraska	2, 073, 781	46, 563, 019	48, 636, 800	213, 374	2, 541, 524
California	11, 427, 105	109, 520, 735	120, 947, 840	477, 880	9, 604, 607
Oregon	2, 389, 252	58, 586, 108	60, 975, 360	761, 001	15, 407, 528
Nevada	208, 510	71, 529, 090	71, 737, 600	13, 415	3, 589, 869
Total of States	405, 226, 769	869, 932, 271	1, 275, 159, 040	158, 867, 227	380, 639, 793

States and Territories.	No. acres in farms.	No. acres not in farms.	No. acres in total area.	No. acres of woodland in farms.	Estimated total acres in woodland.
TERRITORIES.					
Colorado	320, 346	66, 559, 654	66, 880, 000	11, 504	6, 667, 469
Utah	148, 361	53, 916, 682	54, 065, 043	215	5, 391, 883
New Mexico	833, 549	76, 735, 091	77, 568, 640	106, 283	4, 710, 388
Washington	649, 139	44, 147, 021	44, 796, 160	291, 206	14, 859, 722
Dakota	302, 376	96, 293, 752	96, 596, 128	22, 605	2, 911, 417
Montana	139, 537	91, 877, 103	92, 016, 640	1, 198	14, 701, 534
Idaho	77, 139	55, 151, 021	55, 228, 160	7, 476	8, 280, 129
Arizona	21, 807	72, 884, 433	72, 906, 240	....	4, 373, 065
Wyoming	4, 341	62, 640, 727	62, 645, 068	35	5, 011, 293
Indian	....	44, 154, 240	44, 154, 240	....	3, 532, 339
Alaska	....	369, 529, 600	369, 529, 600	....	110, 858, 880
Total of Territories	2, 496, 595	1, 033, 889, 324	1, 036, 385, 919	440, 522	181, 298, 119
Grand total	407, 723, 364	1, 903, 821, 595	2, 311, 544, 959	159, 307, 749	561, 937, 912

Taking into consideration only the farm-lands, the proportion of woodlands is smallest in California, being 4.1 per cent. In order, respectively, follow Nevada, 6.4 per cent.; Nebraska, 10.2; Kansas, 11.2; Iowa, 16.2; Illinois, 19.6. The proportion increases, State by State, from the Pacific coast eastward to Indiana, (39.6 per cent.,) and then comes the devastation of the axe, which reduces the percentage of Ohio, a region originally forest with the exception of small patches of prairie mainly about the head-waters of the Miami, to 31.7 per cent. Pennsylvania has about the same proportion, or 31.9, and New Jersey 24 per cent.

There are only two other Western States that have percentages between 20 and 30, viz, Minnesota, 20.6; Wisconsin, 29.3. The Eastern States (besides New Jersey) which come within the same limits, are Connecticut, 24.4; New York, 25.5; Massachusetts, 25.8; Delaware, 28; New Hampshire, 29; Vermont, 30.6.. Those having between 30 and 40 per cent. of this farm area in forest are: Pennsylvania, Indiana, named above; Oregon, 31.8; Maryland, 31.8; Rhode Island, 33.7; Maine, 38.1. The States having between four and five tenths of their farm-lands in forest are three: Michigan, 40.7; Texas, (the eastern portion generally wooded,) 41.6; Virginia, 45.7. The southern belt is the most heavily wooded portion of the country, all the States, with the exception of Virginia and Texas, having more than half of their farm areas in woodland, and a larger portion still if the wooded wild lands should be counted in with the farm-lands. The proportion in the occupied or farm areas is as follows: West Virginia, 51.1; Arkansas, 51.4; South Carolina, 53.2; Georgia, 54.6; Tennessee, 55; Alabama, 56; Florida, 60; North Carolina and Mississippi, each 60.6 per cent.

The Territories have only a very small portion of their respective areas in farms. Here and there a small survey has been made, near some town, along some stream, or in the neighborhood of mining operations. The areas in wood are mainly among the mountains, the most heavily wooded on northern slopes and in the gorges protected from the winds; the proportion given for farm-lands is therefore, in all probability, less than the real portion for the entire area of a Territory, notwithstanding the fact that available woodlands in surveyed tracts are rapidly taken up by farmers. Utah, one-tenth of one per cent.; Montana and Wyoming, eight-tenths of one per cent.; Colorado, 3.5; Dakota, 7.4; Idaho, 9.6; New Mexico, 12.7; Washington, 44.8.

Most of the States, in their several counties, exhibit great diversity in the abundance of their wood and timber supplies. In the new States it is due to the existence of prairies, or treeless plains, traversed by streams shaded by a line of forest, which characterize the surface of all

or of a portion of a State; in the older States it is simply the result of settlement and cultivation, in the destruction of forests, by clearing land for farms, for supplies of wood for fuel, in obtaining timber for building and for the various uses of mechanism. East of the Alleghanies almost the entire surface of the land was originally in forest. On the very summit of the Alleghanies are comparatively large tracts of level meadows, or mountain prairies, known as "glades," which are found in undrained soils not suited to the growth of trees, though this mountain-chain is generally wooded, on slope and summit, with as fine and various an arborescent growth as can be seen in any part of the North American continent. West of the mountains, through West Virginia, Ohio, and Kentucky, there was little else than forest in the times of the aborigines; and in Northeastern, Southern, and Southwestern Indiana, a wooded surface was the prevailing characteristic, and even now it is a favorite resort for obtaining black walnuts and poplars of enormous size, and great boles of oaks, fit for the masts of many a "man-of-war." The South was and is a wooded region, with very few and small prairies in the valley of the Mississippi, and none really worth mentioning until Central Texas is reached. In Northern Missouri are extensive prairies, but almost half the area of the State is now covered with forest, notwithstanding the extensive clearing of farm-lands during more than fifty years since its settlement; and more than half the surface of Arkansas and Louisiana, both west of the Mississippi, is now covered with wood. Meteorological records show that the lines of equal moisture, in this section, run northeast and southwest, through Western Kansas, Eastern Nebraska, Iowa, and Wisconsin; the records of the rain-fall of any given period correspond on that line, rather than with a line through Kansas and Missouri; so the rains of central Nebraska and Minnesota, in point of time and quantity, correspond more nearly than those of Nebraska and Iowa. As might naturally be expected, we find the forest boundary, from Texas to Illinois, beyond which the prairies stretch westward, running in a general direction corresponding with the lines of equal rain-fall. As a result, (though the lack of trees farther west cannot be attributed to insufficient rain-fall alone,) we find plains predominating in Western Texas, in nearly all of the Indian Territory, in a strip of Western and nearly all of Northern Missouri, in a large portion of Illinois, and in Western and Northern Indiana, nearly to Lake Erie. Southern Illinois has an average proportion of forest, as the accompanying outline map, with figures giving the proportion of woodland to farm area, will show. The entire area of farm-lands in Illinois, as reported by the last census, is 25,882,861 acres, of which 5,061,578 acres, or 19.6 per cent., were reckoned as woodland. The belt south of the Ohio and Mississippi Railroad has a percentage of 43.5, which is greater than that of Missouri, and almost equal to that of Virginia. These counties are as follows:

Counties.	Per cent.	Counties.	Per cent.	Counties.	Per cent.
Monroe	47.1	Hamilton	50.4	Johnson	00.0
Washington	23.7	White	45.5	Pope	61.0
Wayne	48.1	Gallatin	56.8	Hardin	61.3
Edwards	49.0	Saline	49.0	Massac	57.0
Wabash	40.7	Williamson	47.3	Pulaski	39.2
Randolph	53.3	Jackson	50.9	Alexander	56.2
Perry	42.1	Union	50.7	Jefferson	44.2
Franklin	02.3				

The district lying between this railroad and the fortieth parallel contains twenty-nine counties, and averages 25 per cent. of woodland; and is made up as follows:

Counties.	Per cent.	Counties.	Per cent.	Counties.	Per cent.
Macoupin	21.3	Effingham	27.7	Edgar	19.2
Jersey	34.9	Fayette	31.4	Douglas	7.1
Saint Clair	24.7	Bond	22.4	Moultrie	13.6
Clinton	23.5	Madison	24.8	Christian	7.0
Marion	25.7	Greene	31.2	Sangamon	10.3
Clay	34.6	Montgomery	14.3	Morgan	16.9
Richland	39.6	Shelby	18.9	Pike	34.6
Lawrence	44.3	Cumberland	33.2	Scott	33.9
Crawford	37.1	Clark	45.1	Calhoun	61.0
Jasper	39.3	Coles	17.6		

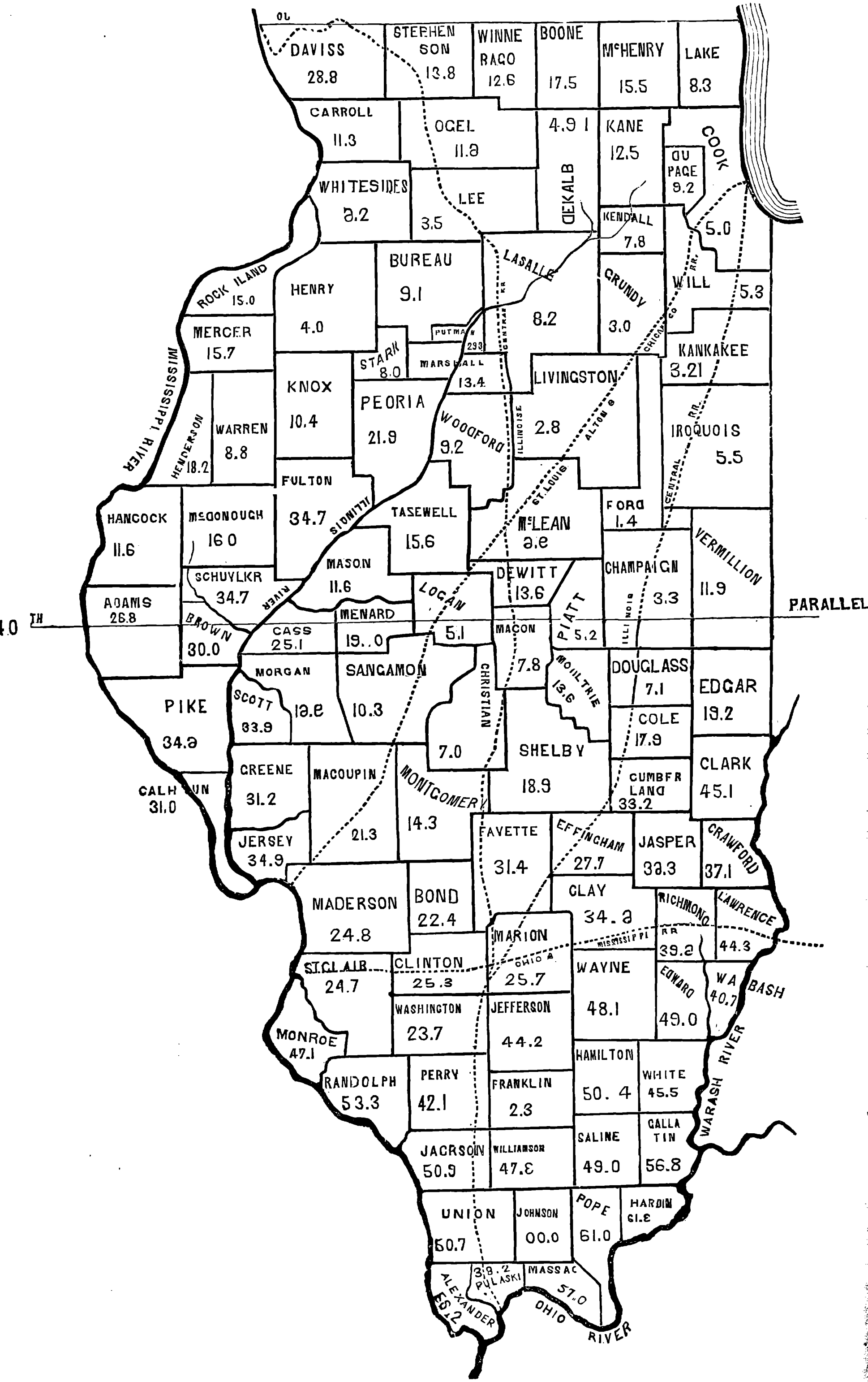
The northern counties between the fortieth parallel and the Wisconsin line make an average of only 11.4 per cent.

Counties.	Per cent.	Counties.	Per cent.	Counties.	Per cent.
Adams	26.8	Iroquois	5.5	Du Page	9.2
Brown	30.0	Livingston	2.8	Kendall	7.8
Cass	25 1	Woodford	9.2	Kane	12.5
Menard	19.0	Peoria	21.9	DeKalb	4.9
Logan	5.1	Knox	10.4	Lee	3.5
Macon	7.8	Warren	8.8	Bureau	9.1
Piatt	5.2	Henderson	18.2	Rock Island	15.0
Champaign	3.3	Mercer	15.7	Whitesides	6.2
Vermillion	11.9	Henry	4.0	Carroll	11.9
Hancock	11.6	Stark	8.0	Ogle	11.6
McDonough	16.0	Marshall	14.3	Lake	8.3
Schuyler	34.7	Putnam	29.3	McHenry	15.5
Fulton	34.7	La Salle	8.2	Boone	17.5
Mason	11.6	Grundy	3.0	Winnebago	12.6
Tazewell	15.6	Kankakee	3.2	Stephenson	13.8
McLean	6.9	Will	5.3	Jo Daviess	28.8
Ford	1.4	Cook	5.0	De Witt	13.6

The influence of the rivers, especially the Mississippi and the Wabash, in extending forests, is plainly marked. From the mouth of the Ohio to the fortieth parallel are eleven counties, Alexander, Union, Jackson, Randolph, Monroe, Saint Clair, Madison, Jersey, Calhoun, Pike, and Adams, and they average 37.3 per cent.; northward, on the Mississippi, Hancock, Henderson, Mercer, Rock Island, Whitesides, Carroll, and Jo Daviess, averaging 14.8 per cent. The tract between the Saint Louis and Alton Railroad and the Illinois River, in the prairie belt, comprising Jersey, Greene, Scott, Morgan, Cass, Mason, Menard, Tazewell, Woodford, Logan, Marshall, Putnam, Grundy, Sangamon, fourteen counties, averages 16 per cent.; and the counties between that road and the Chicago branch of the Central, comprising Madison, Bond, Macoupin, Fayette, Effingham, Shelby, Montgomery, Christian, Kankakee, McLean, De Witt, Macon, Moultrie, Piatt, Ford, Will, and Livingston, comprising seventeen counties, average 13 per cent.

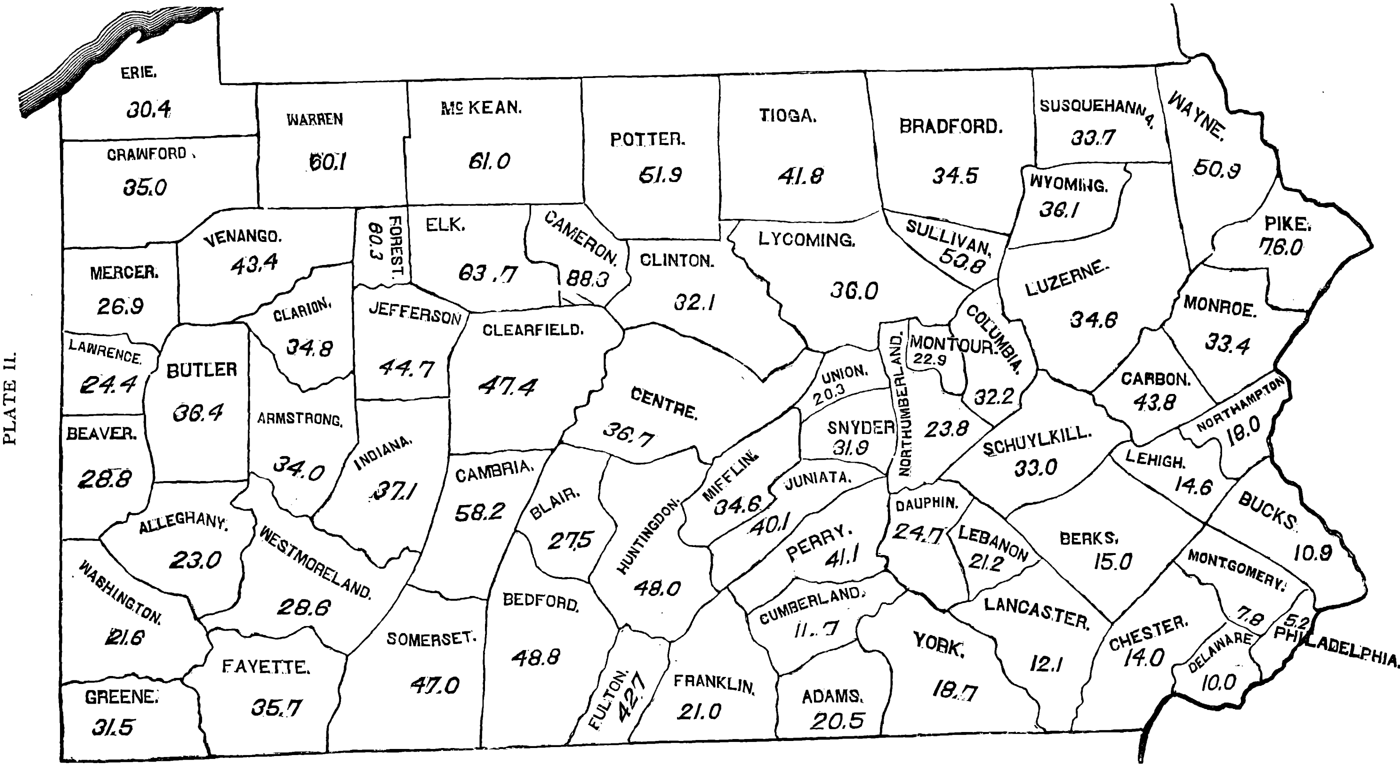
In some of the older States the proportion of woodland is quite as variable as in Illinois. Pennsylvania has an average percentage of 31.9, but Montgomery County has only 7.8, while Cameron has 88.3. The mountain counties have high percentages. On the Delaware, Wayne in the northeast has 50.9, and Pike, 76. The northern tier has more than an average proportion of wood, especially McKean and Warren, which have respectively 61 and 60.1 per cent. The counties bordering on Ohio fall below an average. In the agricultural portion of Eastern Pennsylvania the axe has left only a minimum of wood, Cumberland having only 11.7; Lancaster, 12.1; Chester, 14; Berks, 15; Delaware, near Philadelphia, has but 10; Montgomery, 7.8; and Bucks, 10.9. The accompanying outline map, with plain figures of percentage on each county, will show the progress of destruction of forests in this State:

PLATE I.



FOREST AREA OF ILLINOIS.

PLATE II.



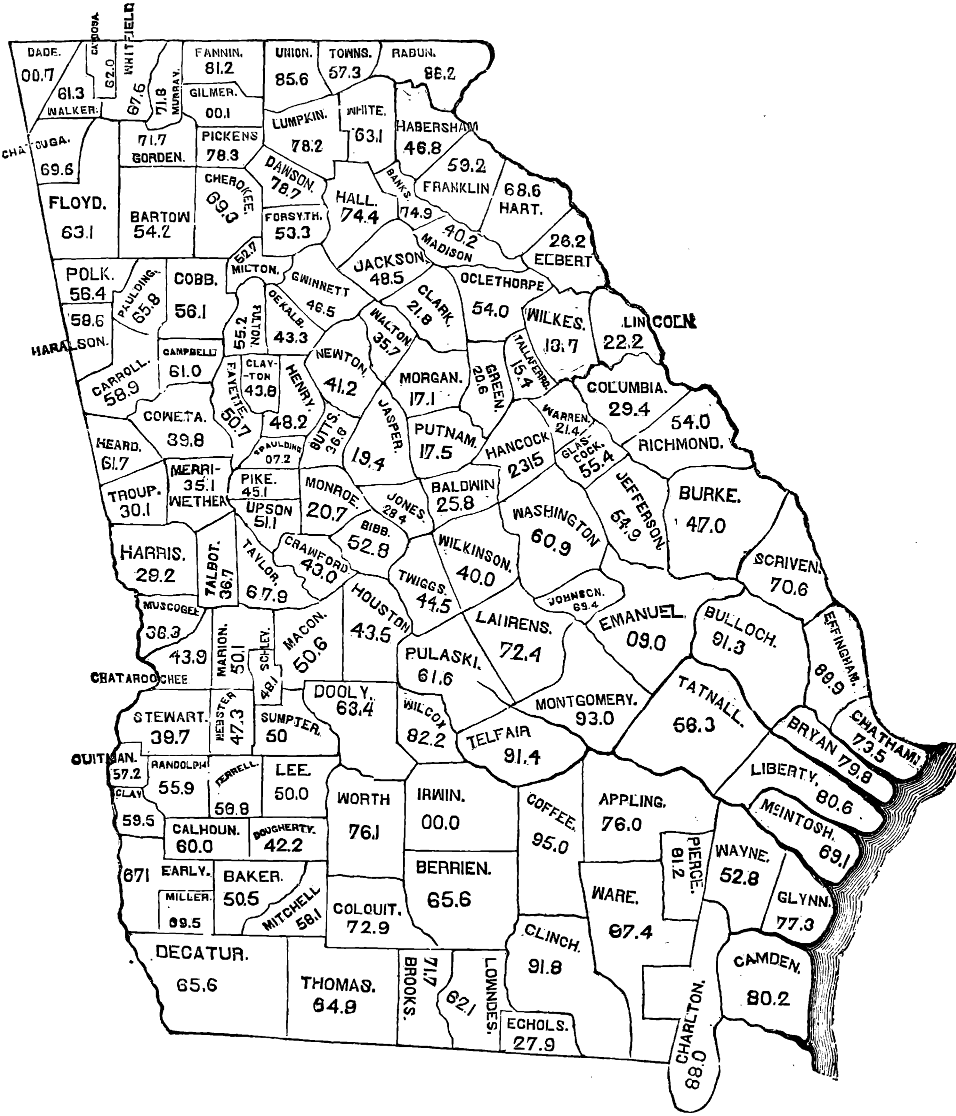
FOREST AREA OF PENNSYLVANIA.

Counties.	Per cent.	Counties.	Per cent.	Counties.	Per cent.
Adams	20.5	Delaware	10.0	Montgomery	7.8
Allegheny	23.0	Elk	63.7	Montour	22.9
Armstrong	34.0	Erie	30.4	Northampton	8.0
Beaver	28.8	Fayette	35.7	Northumberland	23.8
Bedford	48.8	Forest	60.3	Perry	41.1
Berks	15.0	Franklin	21.0	Philadelphia	5.2
Blair	27.5	Fulton	42.7	Pike	76.0
Bradford	34.5	Greene	31.5	Potter	51.9
Bucks	10.9	Huntingdon	48.0	Schuylkill	33.0
Butler	36.4	Indiana	37.1	Snyder	31.9
Cambria	58.2	Jefferson	44.7	Somerset	47.0
Cameron	88.3	Juniata	40.1	Sullivan	53.8
Carbon	43.8	Lancaster	12.1	Susquehanna	33.7
Centre	36.7	Lawrence	24.4	Tioga	41.8
Chester	14.0	Lebanon	21.2	Union	20.3
Clarion	34.8	Lehigh	14.6	Venango	43.4
Clearfield	47.4	Luzerne	34.6	Warren	60.1
Clinton	32.1	Lycoming	36.0	Washington	21.6
Columbia	32.2	McKean	61.0	Wayne	50.9
Crawford	35.0	Mercer	26.9	Westmoreland	28.6
Cumberland	11.7	Mifflin	34.6	Wyoming	36.1
Dauphin	24.7	Monroe	33.4	York	18.7

North Carolina has a wealth of woodland, the percentage to farm area being 60.6, one county, Brunswick, having over 90 per cent., and no less than eleven others between 80 and 90, viz, Bladen, Beaufort, Craven, Cumberland, Jackson, Macon, Mitchell, Onslow, Polk, Transylvania, and Watauga. Some of these are near the ocean and others among the mountains. A difference in altitude of more than 6,000 feet, differences of latitude, of surface, and of soil, render this State remarkable for the variety found in its flora, which ranges from the palmetto to the pine; from semi-tropical forms, to vegetation almost alpine in character. None of the States can exhibit a larger variety of forest growth. The following list of counties will show an unusual proportion of woodland:

Counties.	Per cent.	Counties.	Per cent	Counties.	Per cent.
Alamance	34.8	Edgecombe	52.4	Northampton	47.9
Alexander	74.1	Forsyth	44.9	Onslow	80.1
Alleghany	65.4	Franklin	46.9	Orange	37.9
Anson	35.4	Gaston	52.2	Pasquotank	44.4
Ashe	72.5	Gates	64.7	Perquimans	53.3
Beaufort	84.7	Granville	31.1	Person	33.8
Bertie	68.7	Greene	59.9	Pitt	63.9
Bladen	85.8	Guilford	31.8	Polk	80.2
Brunswick	91.7	Halifax	55.9	Randolph	67.0
Buncombe	73.7	Hanett	79.3	Richmond	75.8
Burke	73.0	Haywood	69.5	Robeson	70.8
Cabarrus	37.4	Henderson	73.1	Rockingham	45.5
Caldwell	71.9	Hertford	66.7	Rowan	35.9
Camden	37.3	Hyde	48.8	Rutherford	64.3
Carteret	63.1	Iredell	43.9	Sampson	76.8
Caswell	28.8	Jackson	89.3	Stanley	66.2
Catawba	21.7	Johnston	66.1	Stokes	64.0
Chatham	48.5	Jones	73.2	Surry	74.1
Cherokee	59.6	Lenoir	54.1	Transylvania	85.2
Chowan	54.3	Lincoln	47.8	Tyrrell	56.1
Clay	76.8	Macon	85.8	Union	58.8
Cleveland	49.6	Madison	78.7	Wake	46.1
Columbus	8.1	Martin	73.1	Warren	47.7
Craven	82.3	McDowell	46.7	Washington	68.4
Cumberland	85.3	Mecklenberg	39.0	Watauga	80.4
Currituck	52.7	Mitchell	80.1	Wayne	63.0
Dare	46.0	Montgomery	61.1	Wilkes	67.9
Davidson	41.8	Moore	73.4	Wilson	60.6
Davie	39.5	Nash	69.8	Yadkin	49.7
Duplin	76.3	New Hanover	78.1	Yancey	77.0

PLATE III.



FOREST AREA OF GEORGIA.

The forest area of Georgia farm-lands is still large—54.6 per cent. Seven counties—Bullock, Clinch, Coffee, Montgomery, Pierce, Telfair, and Ware—have over nine-tenths in woodlands, the latter 97.4 per cent. The following table gives the proportion for each county in Georgia:

Counties.	Per cent.	Counties.	Per cent.	Counties.	Per cent.
Appling	76.0	Fayette	50·7	Muscogee	36.3
Baker	50.5	Floyd	63.1	Newton	41 2
Baldwin	25.8	Forsyth	53.3	Oglethorpe	54.0
Banks	74.9	Franklin	59.2	Paulding	65.8
Bartow	54.2	Fulton	55.2	Pickens	78.3
Berrien	65.6	Gilmer	.1	Pierce	91.2
Bibb	52.8	Glasscock	55.4	Pike	45.1
Brooks	71.7	Glynn	77.3	Polk	56.4
Bryan	79.8	Gordon	71.7	Pulaski	61.6
Bullock	91.3	Greene	20.6	Putnam	17.5
Burke	47.0	Gwinnett	46.5	Quitman	57.2
Butts	36.6	Habersham	46.8	Rabun	88.2
Calhoun	60.0	Hall	74.4	Randolph	55.9
Camden	80.2	Hancock	28.5	Richmond	54.0
Campbell	61.0	Haralson	58.6	Schley	48.1
Carroll	58.9	Harris	29.2	Scriven	70.6
Catoosa	62.0	Hart	68.6	Spalding	7.2
Charlton	88.0	Heard	61.7	Stewart	39.7
Chatham	73.5	Henry	48.2	Sumter	50.5
Chattahoochie	43.9	Houston	43.8	Talbot	36.7
Chattooga	69.6	Irwin	00.0	Taliaferro	15.4
Cherokee	69.3	Jackson	48.5	Tatnall	56.3
Clark	21.8	Jasper	19.4	Taylor	67.9
Clay	59.5	Jefferson	54.9	Telfair	91.4
Clayton	43.8	Johnson	69.4	Terrell	56.8
Clinch	91.8	Jones	28.4	Thomas	64.9
Cobb	56.1	Laurens	72.4	Towns	57.3
Coffee	95.0	Lee	50.0	Troup	30.1
Colquitt	72.9	Liberty	80.6	Twiggs	44.5
Columbia	29.4	Lincoln	22.2	Union	85.6
Coweta	39.8	Lowndes	62.1	Upson	51.1
Crawford	43.0	Lumpkin	78.2	Walker	61.3
Dade	.7	Macon	50.6	Walton	35.3
Dawson	78.7	Madison	40.2	Ware	97.7
Decatur	65.6	Marion	50.1	Warren	21.4
De Kalb	43.3	McIntosh	69.1	Washington	60.9
Dooly	63.4	Meriwether	35.1	Wayne	52.8
Dougherty	42.2	Miller	69.5	Webster	47.3
Early	67.2	Milton	52.7	White	63.1
Echols	27.9	Mitchell	58.1	Whitefield	67.6
Effingham	89.9	Monroe	20.7	Wilcox	82.2
Elbert	26.2	Montgomery	93.0	Wilkes	13.7
Emanuel	9.0	Morgan	17.1	Wilkinson	40.0
Fannin	81.2	Murray	71.6	Worth	76.1

AGRICULTURAL EXPORTS.

Statement of the exports of agricultural products of the United States, with their immediate manufactures, for the year ending June 30, 1872, collated from the report of Edward Young, chief of Bureau of Statistics, Treasury Department.

		Quantity.	Value.
Animals, living:			
Hogs	number..	56,010	$548,153
Horned cattle	number..	28,033	565,719
Horses	number..	1,722	268,475
Mules	number..	2,121	294,402
Sheep	number..	35,218	79,592
All other, and fowls			17,375
Total living animals			1,773,716
Animal matter:			
Bones and bone-dust	cwt..	61,899	$106,567
Bone-black, ivory-black, &c	pounds..	2,[illegible]0,142	46,147
Candles, tallow and other	pounds..	2,299,840	341,210
Furs and fur skins			3,343,005
Glue	pounds..	85,717	17,988
Hair, unmanufactured			348,364
Hair, manufactures of			25,803
Hats, caps, and bonnets of fur, wool, or silk			188,574
Hides and skins other than fur			1,445,178
Leather and manufactures thereof:			
Boots and shoes	pairs..	325,296	502,689
Leather of all kinds not specified	pounds..	12,102,019	2,864,800
Morocco			153,962
Saddlery and harness			65,599
Manufactures not specified			96,979
Oil, lard	gallons..	533,147	432,483
Neat's-foot and other	gallons..	26,393	9,402
Provisions:			
Bacon and hams	pounds..	246,208,143	21,126,592
Beef	pounds..	26,652,094	1,870,826
Butter	pounds..	7,746,261	1,498,812
Cheese	pounds..	66,204,025	7,752,918
Condensed milk			86,808
Eggs	dozen..	5,148	1,048
Lard	pounds..	199,651,660	20,179,619
Preserved meats			697,067
Pork	pounds..	57,169,518	4,122,308
Soaps, perfumed and toilet			9,436
All other	pounds..	8,676,736	606,527
Tallow	pounds..	76,151,218	6,973,189
Wax	pounds..	446,174	126,130
Wool and manufactures thereof:			
Wool, raw and fleece	pounds..	140,515	36,434
Carpets	yards..	870	1,342
Other manufactures			211,327
Total of animal matter			75,287,133
Breadstuffs and products thereof:			
Barley	bushels..	86,891	$63,407
Bread and biscuit	pounds..	10,548,879	629,841
Indian corn	bushels..	34,491,650	23,984,365
Indian-corn meal	barrels..	308,840	1,214,999
Oats	bushels..	262,975	135,129
Rye	bushels..	794,967	703,929
Rye flour	barrels..	6,287	34,401
Wheat	bushels..	26,423,080	38,915,060
Wheat flour	barrels..	2,514,525	17,955,684
Other small grain and pulse			479,449

		Quantity.	Value.
Breadstuffs and products thereof—Continued.			
Maizena and other preparations of breadstuffs used as food			$470,009
Starch	pounds	3,331,763	165,415
Total breadstuffs and their products			84,751,688
Cotton and manufactures thereof:			
Sea-island	pounds	2,709,106	$1,410,303
Other, unmanufactured	pounds	930,828,307	179,274,202
Manufactures colored	yards	2,844,888	458,998
Manufactures uncolored	yards	8,859,191	1,317,719
Manufactures not specified			527,613
Total cotton and its manufactures			182,988,835
Wood and its manufactures:			
Boards, clapboards, deals, planks, joists, &c.	M feet	176,872	$3,466,431
Laths, palings, pickets, &c	M feet	2,723	9,356
Shingles	M feet	27,042	127,338
Box-shooks			113,448
Other shooks, staves, and headings			5,003,551
Hogsheads and barrels, empty	number	159,506	277,307
All other lumber			427,240
Fire-wood	cords	5,428	14,097
Hop, hoop, telegraph, and other poles			534,714
Logs, masts, spars, and other whole timber			362,527
Timber, sawed and hewed	cubic feet	12,594,738	2,107,676
All other timber			99,304
Household furniture			1,493,679
Wooden ware			196,606
All other manufactures of wood not specified			1,007,598
Total wood and its manufactures			15,240,872
Miscellaneous products:			
Brooms and brushes of all kinds			$166,338
Cordage, rope, twine, &c., of all kinds not specified	pounds	2,116,029	362,343
Forest products:			
Ashes, pot and pearl	pounds	1,413,901	108,474
Bark for tanning			166,501
Ginseng	pounds	401,260	341,616
Rosin and turpentine	barrels	692,728	3,256,854
Spirits of turpentine	gallons	4,495,441	2,521,357
Tar and pitch	barrels	36,722	131,010
Fruit and preparations thereof:			
Apples, dried	pounds	2,644,592	190,560
Apples, green or ripe	bushels	100,397	198,948
Other fruits, green, ripe, or dried			164,541
Preserved in cans or otherwise			250,420
Hats and caps of palm-leaf, straw, &c			32,884
Hay	tons	5,266	135,714
Hemp and manufactures thereof:			
Hemp unmanufactured	cwt	561	7,103
Cables and cordage	cwt	9,918	195,901
Other manufactures			114,869
Hops	pounds	3,061,244	408,305
Liquors, fermented, brewed, or distilled:			
Beer, ale, porter, or cider:			
In bottles	dozen	2,205	5,340
In casks	gallons	77,639	27,829
Spirits distilled:			
From grain	gallons	26,606	45,278
From molasses	gallons	882,464	517,556
From other materials	gallons	41,143	28,665
Wine	gallons	31,263	37,713
Oil-cake	pounds	206,970,910	3,966,368
Oil, vegetable:			
Cotton-seed	gallons	547,165	293,546

		Quantity.	Value.
Miscellaneous products—Continued.			
Oil, Linseed		28,375	$26,914
Volatile or essential			235,556
Rice	pounds..	403,835	28,768
Seeds:			
Cotton	pounds..	6,360,109	72,212
Flax or lint	bushels..	600	1,867
Clover, timothy, garden, &c			3,765,025
Sugars and manufactures thereof:			
Sugar, brown	pounds..	17,065	2,170
Sugar, refined	pounds..	4,461,427	561,455
Molasses	gallons..	2,726,858	603,120
Candy and confectionery			22,488
Tobacco and manufactures thereof:			
Leaf	pounds..	234,936,892	24,136,166
Cigars	M..	197	6,648
Snuff	pounds..	15,092	5,241
Other manufactures			2,511,866
Vegetables and preparations thereof:			
Onions	bushels..	80,619	78,988
Pickles and sauces			20,876
Potatoes	bushels..	621,637	482,648
Other vegetables			79,645
Vegetables prepared or preserved			26,168
Vinegar	gallons..	28,435	8,356
Total miscellaneous			46,352,010

RECAPITULATION.

Agricultural products.	Values.		
	1870.	1871.	1872.
Animals, living	$1,045,039	$1,019,604	$1,773,716
Animal matter	35,598,856	45,728,368	75,287,133
Breadstuffs and products thereof	72,302,060	79,320,609	84,751,688
Cotton and manufactures thereof	230,807,951	221,885,245	182,988,835
Wood and manufactures thereof	13,951,326	12,795,829	15,240,872
Miscellaneous	35,969,749	34,932,204	46,352,010
	389,674,981	395,681,859	406,394,254

DISTRIBUTION OF AGRICULTURAL EXPORTS.

The aggregate domestic exports of the United States for the last three fiscal years, together with the proportion of agricultural products, were as follows:

Year.	Total exports.	Exports of agricultural products.	Per cent. of agricultur'l products.
1870	$499,092,143	$389,674,981	78
1871	562,518,651	395,681,859	70
1872	549,219,718	406,394,254	74

While the total export of 1872, compared with 1871, shows a loss of $13,289,933, or 2.3 per cent., the export of agricultural products increased $10,612,395, or 3.15 per cent. Of the latter, all branches show a decided increase except cotton and its manufactures.

Living animals.—Our exports of living animals amounted to $1,773,716, an increase of $754,112, or 75 per cent. Of this amount Canada took $613,005, or over a third, embracing 54,716 hogs, (nearly the whole export,) 346 cattle, 175 horses, 4 mules, and 440 sheep. To the British West Indies we sent 1,144 cattle, 286 horses, 1,725 mules, (seven-eighths of the export,) 3,857 sheep, &c., amounting to $446,122. Cuba received the largest proportion of our cattle, 18,755, and other animals amounting to $366,052. To the British possessions in North America, outside of Canada, we shipped 1,557 cattle, 468 horses, 164 mules, 3,429 sheep, and other animals valued at $133,226. Mexico was our best customer for sheep, taking 27,228, besides 6,121 cattle and other live stock amounting to $103,531. Our only European shipment was to Ireland, 100 sheep, valued at $600. The other exports were mostly to South America and the West Indies.

Animal matter.—Our total export of animal matter, in 1872, was valued at $75,287,133, against $45,728,368 in 1871, and $35,598,856 in 1870. Last year's export may be classified as follows: cattle products, $22,081,220; hog products, $45,859,002; sheep products, $249,103; miscellaneous, $7,097,808. England received of these items, $39,698,462, or considerably over one-half of the whole. Of cattle products she purchased 14,356,368 pounds of beef, 2,645,697 pounds of butter, 52,056,926 pounds of cheese, 35,418,405 pounds of tallow, besides leather, manufactures of leather, condensed milk, neat's-foot oil, candles, and glue, amounting to $13,353,214. Of hog products she took 12,103,556 pounds of pork, 163,397,588 pounds of hams and bacon, 70,131,800 pounds of lard, and 298,368 gallons of lard-oil, amounting in all to $22,247,167. Of sheep products she received only 392 pounds of wool, valued at $460, and wool manufactures worth $10,595. Of miscellaneous animal products she purchased to the amount of $4,087,126, the largest items of which were, furs and fur-skins, $2,492,271; hides and skins, $763,475; preserved meats, $314,728; hair and its products, $228,377, &c. A very large proportion of these exports were for re-export to European and other countries. Ireland is a large consumer of our animal products, yet our direct exports to that island amounted to only $36,873. Scotland shows a larger direct trade, embracing $1,018,028 of cattle products; of hog products, $2,488,695; of sheep products, $1,879; of miscellaneous, $323,835.

On the continent of Europe our three best customers were Germany, France, and Belgium. Germany took cattle products valued at $1,689,550; hog products, $5,709,620; sheep products, $15,260; and miscellaneous, $1,018,950; total, $8,433,380. The largest items in this German trade were 1,490,104 pounds of pork, 18,878,858 pounds of hams and bacon, 40,672,851 pounds of lard, 8,428,396 pounds of cheese, 5,805,344 pounds of tallow, &c. France received 18,455,982 pounds of tallow and other cattle products, amounting to $1,736,049; 13,398,911 pounds of hams and bacon, 15,305,222 pounds of lard and other hog products, amounting to $2,630,014; sheep products, 49,000 pounds of wool, amounting to $19,600; miscellaneous, $72,585; total, $4,458,248. Belgium purchased, direct, $349,374 of cattle products, $1,100 of sheep products, $6,485 of miscellaneous, and $3,720,981 of hog products, the latter embracing 24,657,519 pounds of hams and bacon, 17,635,701 pounds of lard, &c. We drove a good trade with Cuba, sending thither cattle products amounting to $274,966; hog products, $2,632,420; sheep products, (woolen manufactures,) $3,528; miscellaneous, $66,508; total, $2,977,422. With the West Indies and South America our trade was very

considerable, taking less of the raw material and more of the manufactured product.

Breadstuffs.—Our exports of breadstuffs during 1872 amounted to $84,751,688, against $79,320,609 in 1871. Of this aggregate grain amounted to $64,281,339, leaving $20,470,349 for flour, meal, and other manufactures of grain. England received 13,878,146 bushels of wheat, 16,698 bushels of barley, 12,396,575 bushels of barley and other small grains, to the total value of $30,120,132. Of manufactures of grains she imported from this country 208,839 barrels of flour and other items, to the extent of only $1,559,965. Her total import of our breadstuffs, $31,680,097, was somewhat over a third of our whole export. Scotland takes of our grain to the value of $3,723,384, mostly wheat and corn, and of grain manufactures, $721,941. Ireland makes a strong demand upon our breadstuffs, taking 3,939,122 bushels of wheat, and 10,895,539 bushels of corn, which, with a few other small grains, amount to $14,231,718. She takes, however, only $233,346 in grain products. On the continent of Europe, Germany, France, and Belgium are again our leading customers. Germany takes $1,422,494 in grain and $85,909 in grain manufactures; France $2,358,462 and $2,559; Belgium, $2,018,406 and $24,814. In our trade with natives of our own continent, the manufactures of grain reach larger aggregates than the raw material. Canada is the only exception, taking $8,279,555 of the latter and $2,841,434 of the former. The other British American possessions take but $37,546 in grain and $1,296,582 in grain manufactures; British West Indies take $339,242 and $3,894,515; Cuba, $291,811 and $1,226,333; Brazil, $8,935 and $3,200,565; Mexico, $43,118 and $242,151; Venezuela, $52,909 and $306,431; Colombia, $3,682 and $257,230; Hayti, $808 and $435,637; Central America, $7,598 and $345,557; Uruguay, $19,005 and $339,140; Danish West Indies, $7,800 and $394,976. Of Asiatic countries, China takes $9,251 of grain and $921,170 of grain products; Japan, $9,701 and $65,609.

Cotton and cotton manufactures.—Our total export of sea-island cotton was absorbed by England, Germany, and France, the first taking 2,437,640 pounds, the second, 14,143 pounds, and the third, 257,323 pounds. Of other cottons England took 672,813,998 pounds of a total export of 930,928,307 pounds. France stands next in this export trade of raw material, receiving 87,929,860 pounds; Germany took 42,502,461 pounds; Spain, 32,570,783 pounds; Ireland, 28,227,598 pounds; Russia, 24,683,546 pounds; Holland, 22,784,985 pounds; Belgium, 10,098,368 pounds; Italy, 5,922,224 pounds. It thus appears that nearly our whole export was directed to Europe. On this continent, Canada took 1,896,077 pounds; Mexico, 957,209 pounds. Of the entire value represented by this export trade, $182,988,835, raw material represents $180,684,595, leaving but $2,304,330 for all sorts of cotton manufactures. Of the latter our largest exports were to Canada, $349,926; Mexico, $279,292; Brazil, $258,966; Hayti, $128,429; China, $107,616.

Compared with 1871, our cotton export has very seriously declined, the crop of 1871 being only about two-thirds of the product of 1870. Sea-island cotton exports, which constitute but a small fraction of the whole, fell from 3,219,988 pounds to 2,709,106 pounds, and other raw cottons declined from 1,459,715,036 pounds to 930,928,207, a loss of 528,786,829 pounds. Of the declared values of these exports of raw material, sea-island cotton, though more than double the quantity of the previous year's export, shows an aggregate value of only $1,410,303, a loss of $27,236. Other raw cottons declined in value from $216,889,570 to $179,274,292, a loss of $37,615,278. Our exports of cotton man-

ufactures fell from $3,558,136 to $2,304,330, a loss of $1,253,806. Our shipments of colored goods declined from 5,083,923 yards to 2,844,-888 yards; uncolored cottons, from 14,832,931 yards to 8,859,191 yards; other cotton manufactures from a value of $1,056,061 to $527,613. Of our domestic exports it is evident that cotton and its products are not only relatively but absolutely declining.

Forest products.—Of wood in all its stages of preparation for manufacture, and including firewood, our export during 1872 amounted to $12,265,682, an increase of $1,749,887. The largest shipments were to Cuba, $3,063,868; England, $1,921,537; Spain, $837,653; Peru, $781,415; British West Indies, $673,123; Porto Rico, $651,582; Canada, $611,299, &c. Of manufactures of wood, we exported $2,975,190, an increase of $574,443. Of these, our largest shipments were to Canada, $541,801; Cuba, $352,868; Australia and New Zealand, $302,216; Peru, $251,788, &c. Of bark, for tanning, we sent to England, $74,495; to Germany, $34,334; to France, $30,988; to Scotland, $19,330, &c.; the total amount being $166,501, against $96,195 the previous year. Of pot and pearl ashes, France took $74,844, England $12,350, &c., the total export being $108,474, against $103,249 in 1871. Of rosin, turpentine, spirits of turpentine, tar, and pitch, our export amounted to $5,909,221, that of 1871 being $2,604,043. Our best customers were England and Germany, the former taking $2,525,272, and the latter $866,198. Of ginseng, we sent to China $340,686, and to Japan, $930; total, $341,616, against $119,385 the previous year. Our total export trade in forest products amounted to $21,766,684, against $15,934,414 in 1871. Of this amount, England took $4,713,620; Cuba, $3,463,917; Germany, $1,334,770; Canada, $1,304,852; Peru, $1,055,204; Ireland, $971,357; Spain, $879,363; British West Indies, $768,756, &c.

Liquors, fermented, brewed, and distilled.—Of native wine we sent $12,624 to Central America, $6,913 to Canada, $4,393 to Mexico, $2,252 to Colombia, $1,733 to England, &c., the total amount being $37,713, against $26,444 the previous year. Our exports of beer, ale, &c., amounted to $33,169, those of 1871 being $38,378. Our largest shipment, $21,499, was to Cuba. Of grain-spirits we sent but $45,278, the export of the previous year being $68,601; the largest amount, $8,776, was taken by the Sandwich Islands. We increased our export of molasses spirits from $376,957 to $517,556, the largest shipment, $428,509, being to the British African possessions. Of all other spirits we shipped but $28,665. The total export of all kinds of liquor amounted to $662,381, of which $428,737 went to the British possessions in Africa. The export of 1871 was $517,368.

Sugar and its preparations.—Of brown sugar, we exported $2,170; of refined sugar, $561,455; of molasses, $603,120; of candy and confectionery, $22,488; total, $1,189,233, the export of 1871 being $1,228,214. All branches of this trade declined, except refined sugar, which rose from $500,986 to $561,455. Our largest shipments were to England, $314,485; Colombia, $149,492; Chili, $145,642; Scotland, $144,591; Germany, $120,986, &c.; total, $1,189,233.

Seeds, vegetable oils, oil-cake.—Cotton-seed, for the first time, appears in foreign trade, showing an aggregate of 6,360,109 bushels, valued at $72,212. Of this amount England took 4,606,451 bushels, valued at $48,831, and Ireland 1,682,710 bushels, valued at $20,900. Of flaxseed, we shipped 600 bushels, worth $1,867, and of all other seeds, $3,765,025. Of linseed-oil, our shipment amounted to 28,375 gallons, valued at $26,914. Of cotton-seed oil, our first shipment, we exported 547,165 gallons, valued at $293,546. Of oil-cake, we sent out 206,970,910

pounds, valued at $3,966,368. The aggregate value of all these articles was $8,361,488, against $6,546,144 in 1871. Three-fourths of this trade was with the British islands, England taking $5,552,824, including 190,995,812 pounds of oil-cake, valued at $3,648,824. Our trade with Germany amounted to $1,589,635.

Tobacco and its products.—Our total export of tobacco and its preparations amounted to $26,659,921, against $21,993,957 in 1871. Of this aggregate, $24,136,166 represented 234,936,892 pounds of leaf-tobacco, leaving but $6,648 for cigars, $5,241 for snuff, and $2,511,866 for all other preparations of tobacco. The largest shipment was to Germany, $7,024,515; England took $6,848,505; France, $3,541,226; Italy, $2,393,870; Holland, $1,533,275.

Miscellaneous vegetable matter.—Of various articles included under this head, we exported $2,953,373, viz: fruit and its preparations, $804,469; vegetables, dry, dried, canned, pickled, &c., $688,323; hay, $135,714; vinegar, $8,356; hemp, $7,103; hemp manufactures, $310,770; cordage, &c., $362,343; hats and caps of straw, &c., $32,884; rice, $28,768; brooms, $166,338; hops, $408,305. Our shipments of all these articles were in excess of 1871, except vinegar, hats, caps, and brooms.

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries during the fiscal year ending June 30, 1872.

LIVING ANIMALS.

	Hogs.		Cattle.		Horses.		Mules.		Sheep.		All other and fowls.	Total.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Value.	Value.
Ireland									100	$600		$600
Dominion of Canada	54, 716	$540, 948	346	$14, 120	175	$55, 800	4	$350	440	1, 461	$326	613, 005
Other British North American possessions	334	3, 135	1, 557	68, 960	468	29, 780	164	16, 125	3, 429	15, 321	5	133, 226
British West Indies	15	325	1, 144	99, 320	286	67, 425	1, 725	246, 739	3, 857	32, 213	100	446, 122
Cuba	371	1, 758	18, 755	311, 450	101	36, 900	47	8, 105	12	206	7, 633	366, 052
Porto Rico			4	310	25	8, 271	30	5, 440				14, 021
Other Spanish possessions			1	100								100
French American possessions			6	725	166	25, 580	70	9, 180	2	14		35, 499
Brazil	599	1, 050										1, 050
China			27	1, 800					14	120		1, 920
Mexico	51	127	6, 121	53, 085	452	16, 153	35	873	27, 228	25, 843	7, 450	103, 531
Japan	6	153	30	5, 874	8	5, 850			44	3, 050		14, 927
Colombia	9	347	25	8, 850	15	17, 151			90	664	1, 620	28, 632
Sandwich Islands					6	1, 065					35	1, 100
Hayti	5	150									79	229
San Domingo											32	32
Central America	4	160	17	1, 125	12	2, 850			2	100		4, 235
Danish West Indies					8	1, 650	46	7, 590			95	9, 335
Total	56, 110	548, 153	28, 033	565, 719	1, 722	268, 475	2, 121	294, 402	35, 218	79, 592	17, 375	1, 773, 716

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

ANIMAL MATTER—*Cattle products.*

	Beef.		Butter.		Cheese.		Tallow.		Leather.	Leather manufactures.	Condensed milk.	Neat's-foot oil.	Candles.	Glue.	Total.
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Value.	Value.	Value.	Value	Value.	Value	Value.
England	14 356, 368	$1, 017, 485	2, 645, 697	$451, 039	52, 056, 926	$6, 095, 280	35, 418, 405	$3, 214, 144	$2, 522, 106	$20, 957	$26, 736	$5, 285	$	$182	$13, 353, 214
Scotland	2, 015, 041	153, 272	835, 535	127, 509	4, 264, 136	468, 811	2, 682, 838	252, 629	14, 642	1, 165					1, 018, 028
Ireland	21, 000	1, 597			39, 440	5, 096	120, 249	11, 651		45					18, 299
Gibraltar	4, 500	374													374
Dominion of Canada	1, 005, 206	59, 685	270, 854	44, 280	34, 334	3, 618	887, 757	83, 061	44, 438	67, 328		1, 410	3, 653	11, 993	319, 466
British North America	577, 371	30, 255	414, 533	62, 888	68, 260	8, 649	3, 120	278	66, 317	72, 868	82	81	8, 253	270	249, 941
British West Indies	2, 861, 109	217, 982	879, 613	176, 074	592, 800	86, 630	35, 158	3, 583	7, 171	58, 326	5, 397		126, 771		681, 934
British Africa	132, 000	10, 281	12, 170	3, 907			106, 248	12, 400		275	803		200		27, 866
British East Indies	20, 000	1, 500													1, 500
Australia, New Zealand, &c	2, 000	100							246	9, 631	1, 867		1, 750		13, 594
Spain	46, 790	1, 715	64	26			771, 678	51, 770							53, 511
Cuba	238, 284	14, 390	464, 637	94, 264	92, 533	11, 131	794, 105	66, 119	17, 892	49, 201	8, 404		9, 543	4, 022	274, 966
Porto Rico	92, 198	5, 810	380, 480	73, 964	218, 871	27, 584	20, 407	2, 256	342	4, 107	82	36	59, 815		173, 996
Other Spanish possessions			300	60	201	20	3, 000	334			45				459
Germany	1, 223, 969	76, 583	238, 046	39, 266	8, 428, 396	976, 161	5, 805, 344	519, 988	76, 553	815			184		1, 689, 550
France	230, 790	17, 360	966	115	2, 612	388	18, 455, 982	1, 718, 061		125					1, 736, 049
French America	618, 688	46, 896	43, 275	8, 462	4, 048	614	23, 220	2, 378	1, 179	3, 578	30		4, 640		67, 777
Other French possessions	68, 100	5, 132	9, 522	2, 808	7, 985	1, 295	1, 244	112	283	6, 699	13	42			16, 384
Brazil	65, 700	5, 696	47, 966	10, 859	2, 490	332	3, 000	380	1, 393	8, 840	5, 471	47	3, 505		36, 523
China	319, 600	21, 111	139, 699	44, 850	5[illegible], 154	14, 385			7, 062	5, 865	15, 760		1, 680		110, 713
Argentine Republic										8, 495				140	8, 635
Holland	42, 500	3, 875					4, 542, 441	427, 415							431, 290
Dutch East Indies	12, 000	838	3, 857	1, 156							50				2, 044
Dutch West Indies and Guiana	722, 630	36, 861	101, 401	21, 474	5, 717	848	8, 926	899	4, 585	3, 544	78		7, 692	113	76, 094
Mexico	7, 935	694	117, 312	30, 048	52, 922	8, 627	84, 676	8, 716	2, 564	114, 065	505	48	21, 625	875	187, 767
Italy	1, 300	125					12, 013	1, 000							1, 125
Venezuela	12, 290	883	40, 194	9, 627	16, 564	2, 869	1, 046, 747	110, 902	108	1, 958	52	8	14, 883		141, 290
Belgium	11, 040	773	659	125			3, 896, 582	348, 346			130				349, 374
Japan	136, 600	7, 743	101, 530	32, 882	35, 406	5, 890			84, 138	69, 147	6, 387		599		206, 786
Colombia	440, 017	41, 317	489, 854	142, 495	38, 264	5, 758	31, 266	3, 412	6, 571	15, 845	3, 976		24, 035	122	243, 531
Sandwich Islands	27, 000	2, 854	1, 960	568	11, 785	1, 878			2, 090	40, 788	368				48, 546
Uruguay							7, 000	699		1, 306	291		753		3, 049
Russia on the White and Baltic Seas							48, 499	4, 150							4, 150
Hayti	298, 072	22, 822	189, 977	44, 792	72, 035	12, 299	1, 082	101	800	32, 748	60		16. 669	90	130, 381

San Domingo	25, 150	1, 789	100, 926	22, 982	28, 372	4, 457	1, 000	175	238	9, 226	250	......	5, 476	56	44, 649
Peru	313, 057	18, 943	30, 597	11, 698	325	63	87, 150	8, 965	....	7, 920	530	25	2, 847	50	51, 041
Central America	96, 724	6, 589	46, 755	12, 300	30, 139	4, 748	13, 390	1, 385	713	25, 974	1, 399	......	5, 887	75	59, 070
Chili	190, 400	10, 627	....	....	....	....	....	....	....	3, 281	6, 955	2, 420	......	......	23, 283
Denmark	....	....	....	....	....	....	258, 697	23, 743	....	......	......	......	......	......	23, 743
Danish West Indies	266, 465	16, 575	121, 341	24, 195	24, 680	2, 928	9, 767	985	3, 294	9, 731	983	......	19, 457	......	78, 148
Portugal	30, 000	2, 400	....	....	8, 067	1, 134	241, 840	24, 286	....	......	90	......	......	......	27, 910
Portuguese possessions	54, 900	3, 527	3, 807	1, 067	2, 119	285	....	....	75	......	......	......	60	......	5, 014
Sweden and Norway	....	....	....	....	....	....	728, 387	68, 866	....	......	......	......	......	......	68, 866
Austria	....	....	....	....	....	....	....	....	....	......	......	......	......	......	....
Turkey	....	....	200	50	....	....	....	....	....	......	......	......	......	......	50
Greece	....	....	....	....	....	....	....	....	....	......	......	......	......	......	....
Liberia	49, 700	2, 528	2, 854	820	1, 263	207	....	....	....	2, 313	14	......	......	......	5, 882
Other countries	15, 600	1, 929	9, 680	2, 162	5, 181	933	....	....	....	9, 101	......	......	1, 233	......	15, 358
Total	26, 652, 094	1, 870, 826	7, 746, 261	1, 498, 812	66, 204, 025	7, 752, 918	76, 151, 218	6, 973 189	2, 864, 800	665, 267	86, 808	9, 402	341, 210	17, 988	22, 081, 220

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

ANIMAL MATTER—*Hog and sheep products.*

	Pork.		Hams and bacon.		Lard.		Lard-oil.		Total of hog products.	Wool.		Manufactures of wool.	Total sheep products.
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Gallons.	Value.	Value.	Pounds.	Value.	Value.	Value.
England	12,103,556	$911,989	163,397,588	$14,037,448	70,131,800	$7,065,912	298,368	$231,818	$22,247,167	392	$460	$10,595	$11,055
Scotland	866,800	62,937	11,711,571	1,125,614	8,612,643	884,735	87,080	75,409	2,488,695			1,879	1,879
Ireland	33,200	2,639			18,750	1,875			4,514				
Gibraltar	7,000	700							700				
Dominion of Canada	12,846,262	905,000	894,081	91,565	846,145	85,926	32,020	28,356	1,110,847	4,118	1,361	142,830	144,191
Other British North America	4,791,421	291,410	416,515	56,043	93,404	12,776	1,406	989	361,218			14,540	14,540
British West Indies	8,137,366	591,446	1,076,304	103,538	2,582,739	270,915	19,163	15,635	981,534	5	13	726	739
British Africa	202,200	14,095	19,813	2,490	110,840	12,717	1,324	1,192	30,494			1,722	1,722
British East Indies													
Australia, New Zealand, &c	86,600	5,922					2,841	2,900	8,822			1,413	1,413
Other British possessions													
Spain	16,000	623	50,841	4,132	86,114	8,276			13,031				
Cuba	641,209	48,078	7,615,856	732,713	18,676,287	1,848,271	4,036	3,358	2,632,420			3,528	3,528
Porto Rico	1,813,250	131,635	762,093	97,391	1,462,571	162,250	302	253	391,529			209	209
Other Spanish possessions			1,576	173	1,200	146			319				
Germany	1,490,104	127,443	18,878,858	1,581,133	40,672,851	3,998,293	3,684	2,751	5,709,620	87,000	15,000	260	15,260
France	1,149,027	85,542	13,398,911	1,065,195	15,305,222	1,450,990	36,063	28,287	2,630,014	49,000	19,600		19,600
French America	965,825	79,776	214,119	28,295	270,286	33,642			141,713			5	5
Other French possessions	20,600	2,090	12,025	1,827	28,896	3,668			7,585			558	558
Brazil	30,480	2,902	33,380	4,357	1,591,742	198,560	1,164	961	206,780			8,997	8,997
China	335,420	25,794	22,559	2,815	4,467	567			29,176			5,133	5,133
Argentine Republic	4,400	328	16,076	2,134	258,360	31,308			33,770			1,638	1,635
Holland			91,360	6,116	8,561,596	856,237			862,353				
Dutch East Indies	10,000	600	2,250	280	2,500	287			1,167				
Dutch West Indies and Guiana	684,929	49,146	203,835	16,444	219,910	23,696	322	265	89,551			181	181
Mexico	13,646	818	296,001	31,686	1,079,754	121,082	1,041	1,158	154,744			7,085	7,085
Italy	750	75	1,981	200					275				
Venezuela	31,300	2,153	67,604	9,118	446,457	46,627	42	37	57,935				
Belgium	361,000	28,950	24,657,519	1,907,408	17,657,701	1,783,770	1,093	853	3,720,981			1,100	1,100
Japan	53,620	4,355	44,267	6,771	16,026	2,144			13,270			910	910
Colombia	319,670	29,484	46,794	7,229	5,582,119	665,528	9,247	7,835	710,076			718	718
Sandwich Islands	11,100	1,098	20,707	3,234	6,740	902	130	163	5,397			942	942
Uruguay	14,000	874	9,102	1,270	311,340	39,304	2,000	2,500	43,948			860	860
Russia on the Baltic and White Seas													
Russia on the Black Sea													
Hayti	8,567,664	603,368	208,947	27,779	632,854	81,950	1,694	1,489	714,586			322	322

San Domingo	195,050	14,434	38,676	5,027	67,761	8,451			27,912			72	72
Peru	229,600	18,844	15,469	2,258	2,500,485	293,833	12,299	10,569	325,504			330	330
Central America	424,800	28,227	39,316	5,666	63,497	7,570	513	518	41,981			4,125	4,125
Chili	110,600	6,971	2,998	389	317,650	39,378	16,570	14,507	61,345			855	855
Denmark					1,083,945	97,822			97,822				
Danish West Indies	490,169	35,131	87,707	8,916	229,480	25,390	745	680	70,117			175	175
Portugal	30,000	2,109	5,358	852	8,682	1,040			3,992				
Portuguese possessions	16,700	1,100	6,767	943	9,910	1,182			3,225			243	243
Sweden and Norway			1,784,986	142,887	95,470	10,170			153,057				
Austria													
Turkey													
Greece													
Liberia	52,400	3,430	47,479	4,373	1,916	243			8,046				
Other countries	11,860	801	6,854	883	1,550	186			7,585			718	718
Total	57,169,518	4,122,308	246,208,143	21,126,592	199,651,669	20,177,619	533,147	432,483	45,859,002	140,515	36,431	212,669	249,103

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Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

ANIMAL PRODUCTS—*Miscellaneous.*

	Bones and their products.	Hides and skins.	Furs and fur-skins.	Hair and its products.	Preserved meats.	Eggs.	Wax.	Soap.	Hats and caps of wool, fur, or silk.	Morocco.	Total.
	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.
England	$69,002	$763,475	$2,492,271	$228,377	$314,728		$85,481	$3,950	$600	$129,242	$4,087,126
Scotland	27,775			100,712	194,263		1,020	65			323,835
Ireland	12,900			1,155							14,055
Gibraltar					840						840
Dominion of Canada	1,173	500,136	45,830	4,751	3,155	$239	1,982	6,525	126,601	2,050	692,442
Other British American possessions		4,953	17,297		12,802	443		16,890	12,618	440	65,443
British West Indies	6	584		61	33,381	11		35,654	705	256	70,658
British Africa				240	16,528			4,112			20,880
British East Indies											
Australia, &c					9,531			343		1,374	11,248
Other British possessions											
Spain					490		10,952				11,442
Cuba	11,497	49	157	14,786	2,946	355		30,501	178	6,039	66,508
Porto Rico	10	150			960			9,779	813	771	12,483
Other Spanish possessions											
Germany	5,042	154,611	775,234	15,427	41,717		17,387	1,819	702	7,011	1,018,950
France	19,440	14,209	11,061	7,223	16,956		2,013	1,653		30	72,585
French America					213			321	1,310		1,844
Other French possessions					1,540			451	1,434		3,425
Brazil		22			1,179			7,410	130	702	9,443
China	360		1,000		4,877		858	4,260	366	1,679	13,400
Argentine Republic					760						760
Holland					180		1,894				2,074
Dutch East Indies					335						335
Dutch West Indies and Guiana				22	4,912			6,154	273	29	11,390
Mexico	229	226		986	4,073			62,847	12,272	416	81,049
Italy					39						39
Venezuela	9	119		168	1,496			12,385	856	330	15,354
Belgium				13	2,319		4,153				6,485
Japan					2,036			1,867	8,431	19	12,353
Colombia	12	184	145		3,624		272	75,279	1,181	160	80,857
Sandwich Islands				57	1,607				9,997	154	11,815
Uruguay				25	930						955

Russia on the Baltic and White Seas		4,172									4,172
Russia on the Black Sea											
Hayti	90			70	2,421			262,128	5,820	75	270,604
San Domingo	5	254		56	294		40	49,337	2,918	1,319	54,223
Peru	4,585				6,542			1,949		1,213	14,289
Central America	561	72	10	35	2,986		78	6,820	126		10,688
Chili	18				2,174			720	26	347	3,285
Denmark											
Danish West Indies		409		3	2,921			3,329	438	306	7,406
Portugal					189			120			309
Other Portuguese possessions					46			1,022			1,068
Sweden and Norway											
Austria											
Turkey											
Greece											
Liberia					462			236			698
Other countries		1,562			615			7,871	779		10,827
	152,714	1,445,178	3,343,005	374,167	697,067	1,048	126,130	615,963	188,574	153,962	7,097,808

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

BREADSTUFFS—*Grain.*

	Wheat.		Rye.		Barley.		Corn.		Oats.		Other small grain and pulse.	Total.
	Bushels.	Value.	Bushels.	Value.	Bush'ls.	Value.	Bushels.	Value.	Bushels.	Value.	Value.	Value.
England	13, 878, 146	$20, 853, 047			16, 698	$12, 689	12, 396, 575	$9, 221, 546	48	$27	$32, 823	$30, 120, 132
Scotland	1, 200, 143	1, 796, 053	6, 000	$5, 500	22, 574	16, 100	2, 487, 217	1, 870, 991			34, 740	3, 723, 384
Ireland	3, 939, 122	6, 198, 631					10, 895, 539	8, 031, 929			1, 158	14, 231, 718
Gibraltar							20, 595	16, 000				16, 000
Dominion of Canada	3, 709, 065	4, 444, 166	31, 570	20, 812	14, 050	7, 280	7, 318, 500	3, 763, 043	107, 597	39, 482	4, 772	8, 279, 555
British North America	2, 477	3, 187			17, 768	14, 622	10, 598	8, 440	10, 712	5, 864	5, 433	37, 546
British West Indies, &c							190, 695	164, 492	52, 748	34, 807	139, 943	339, 242
British Africa											56	56
Australia, &c	153	200			3, 360	2, 352			140	78	60	2, 690
Other British possessions												
Spain	800	1, 217					8, 955	6, 347			24	7, 588
Cuba	110	202			36	31	107, 602	79, 046	47, 664	27, 551	184, 981	291, 811
Porto Rico									6, 366	4, 512	7, 234	11, 746
Other Spanish possessions							791	719				719
Germany	290, 737	429, 769	471, 944	420, 112			736, 914	571, 303			1, 310	1, 422, 494
France	1, 429, 688	2, 233, 164					161, 496	114, 388			10, 910	2, 358, 462
French America							15, 874	13, 596	7, 787	4, 725	9, 901	28, 222
Other French possessions	2, 309	3, 097			3, 469	2, 733					446	6, 276
Brazil							8, 788	8, 099			836	8, 935
China	30	46			227	166			4, 780	2, 829	6, 210	9, 251
Argentine Republic							12, 991	10, 083				10, 083
Holland	244, 117	356, 290	144, 122	127, 523			27, 892	19, 935				503, 748
Dutch East Indies	1, 039	1, 272							1, 026	608	514	2, 394
Dutch West Indies and Guiana							9, 100	7, 702	165	115	2, 394	10, 211
Mexico					1, 454	1, 374	21, 039	27, 233	440	288	14, 223	43, 118
Italy												
Venezuela	22, 566	39, 076					11, 855	9, 777	77	47	4, 009	52, 909
Belgium	1, 275, 101	1, 887, 714	140, 776	129, 467			1, 677	1, 225				2, 018, 406
Japan	47	67			6, 373	5, 288	113	126	4, 893	2, 872	1, 384	9, 701
Colombia					58	53	778	600	502	310	2, 719	3, 682
Sandwich Islands	430	558			366	323	59	68	13, 876	8, 074	817	9, 840
Uruguay							22, 704	18, 800			205	19, 005
Hayti							2	2	512	335	471	808
San Domingo			350	314					119	93	193	600
Peru									718	463	1, 822	2, 285
Central America	125	149			458	396	1, 183	1, 047	2, 041	1, 274	4, 732	7, 598
Chili											10	10
Denmark												

Danish West Indies	....	....	205	204	....	....	2,214	1,936	964	775	4,888	7,800
Portugal	426,884	667,155	....	....	....	....	16,150	13,039	....	....	....	680,194
Portuguese possessions	....	....	....	....	....	....	3,754	2,853	....	....	69	2,922
Sweden and Norway	....	....	....	....	....	....	....	....	....	....	....	....
Austria	....	....	....	....	....	....	....	....	....	....	....	....
Turkey	....	....	....	....	....	....	....	....	....	....	....	....
Greece	....	....	....	....	....	....	....	....	....	....	....	....
Liberia	....	....	....	....	....	....	....	....	....	....	....	....
Other countries	....	....	....	....	....	....	....	....	....	....	198	198
	26,423,080	38,915,060	794,967	703,929	86,891	63,407	34,491,650	23,984,365	262,975	135,129	479,449	64,281,339

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

BREADSTUFFS—*Manufactures of grain.*

	Wheat-flour.		Bread and biscuit.		Rye-flour.		Corn-meal.		Maizena, &c.	Starch.	Total value.
	Barrels.	Value.	Pounds.	Value.	Barrels.	Value.	Barrels.	Value.	Value.	Value.	
England	208, 839	$1, 347, 258	1, 860	$127			1, 607	$7, 004	$199, 671	$5, 905	$1, 559, 965
Scotland	98, 957	687, 737							32, 550	1, 654	721, 941
Ireland	20, 948	144, 938	17, 760	888			150	540	84, 968	2, 012	233, 346
Gibraltar	1, 277	8, 180									8, 180
Dominion of Canada	338, 032	2, 303, 838	62, 454	5, 648	941	$4, 718	137, 203	524, 515	1, 211	1, 504	2, 841, 434
British North America	192, 056	1, 241, 561	168, 354	9, 461	10	65	8, 918	33, 840	11, 026	629	1, 296, 582
British West Indies	421, 963	2, 993, 546	7, 545, 595	421, 705	366	1, 959	108, 529	434, 369	36, 211	6, 725	3, 894, 515
British Africa	1, 530	12, 665	133, 235	8, 605			53	222	6, 119		27, 611
British East Indies	100	900									900
Australia	2, 751	17, 022							15, 051	884	32, 957
Other British possessions	40	325									325
Spain	250	1, 925					1	3	611	100	2, 639
Cuba	164, 146	1, 180, 436	162, 738	12, 394	2	10	5, 239	21, 608	10, 937	948	1, 226, 333
Porto Rico	65, 706	502, 218	413, 208	27, 836	90	483	11, 916	49, 381	3, 483	80	583, 481
Other Spanish possessions	8, 860	57, 030	450	80							57, 110
Germany	3, 364	27, 127	3, 235	181	155	722	25	112	18, 585	39, 182	85, 909
France	247	1, 593					6	30	919	17	2, 559
French America	62, 753	473, 055	107, 357	6, 492	190	1, 155	1, 141	4, 792	3, 046	39	488, 579
Other French possessions	8, 133	54, 041	158, 091	10, 025					505		64, 571
Brazil	382, 216	3, 166, 235	256, 681	24, 072	10	60	4	24	7, 691	2, 483	3, 200, 565
China	152, 951	916, 496	4, 839	260	5	41	11	64	4, 263	46	921, 170
Argentine Republic	4, 789	35, 862	20, 118	1, 032			475	1, 722	313	51, 316	90, 245
Holland	1, 148	7, 737	2, 000	150							7, 887
Dutch East Indies	10, 930	64, 386	3, 114	271					268		64, 925
Dutch West Indies	32, 842	250, 996	256, 406	14, 570	1, 603	8, 691	5, 256	25, 253	954	16	300, 480
Mexico	28, 764	218, 279	175, 394	12, 316			29	173	6, 792	4, 592	242, 151
Italy	40	320							150		470
Venezuela	38, 422	296, 763	44, 724	3, 589	280	1, 418	401	1, 584	2, 902	175	306, 431
Belgium	4, 341	23, 367							1, 447		24, 814
Japan	9, 148	60, 810	68, 709	3, 486	10	68			1, 245		65, 609
Colombia	30, 710	243, 182	125, 339	10, 492	2	8	223	939	2, 124	485	257, 230
Sandwich Islands	8, 106	50, 120	184, 845	11, 158			4	27	5, 340	90	66, 735
Uruguay	40, 407	301, 494							480	37, 166	339, 140
Hayti	55, 863	425, 6[illegible]2	116, 011	8, 762			14	70	1, 025	98	435, 637
San Domingo	16, 982	146, 042	46, 279	3, 267			28	111	162	99	149, 681
Peru	240	1, 350	6, 830	634					537	1, 942	4, 463
Central America	48, 702	329, 213	147, 994	10, 750	36	210	396	1, 498	3, 679	207	345, 557
Chili			1, 250	125			5	33			158
Denmark											

Danish West Indies	32, 379	254, 954	121, 297	7, 433	2, 587	14, 793	27, 097	106, 640	4, 200	6, 956	394, 976
Portugal	4, 648	33, 386							83		33, 469
Portuguese possessions	3, 140	24, 732	84, 270	6, 725			70	267		66	31, 790
Sweden and Norway											
Austria											
Turkey									60		60
Greece											
Liberia	875	6, 778	11, 705	801			39	178			7, 757
Other countries	7, 140	42, 105	96, 737	6, 506					1, 401		50, 012
Total	2, 514, 535	17, 955, 684	10, 548, 879	629, 841	6, 287	34, 401	308, 840	1, 214, 999	470, 009	165, 415	20, 470, 349

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

Cotton and manufactures thereof.

	Sea Island.		Other cotton.		Colored goods.		Uncolored goods.		Other manufactures.	Total.
	Pounds.	Value.	Pounds.	Value.	Yards.	Value.	Yards.	Value.	Value.	Value.
England	2, 437, 640	$1, 225, 957	672, 813, 998	$128,865,419	2, 560	$500	147, 501	$44, 087	$27, 240	$130, 163, 203
Scotland			435, 529	86, 527			2, 185	875	1, 616	89, 018
Ireland			28, 227, 598	5, 784, 167					7, 794	5, 791, 961
Dominion of Canada			1, 896, 077	334, 039	9, 652	1, 375	329, 668	101, 615	246, 936	683, 965
Other British North America					43, 337	5, 754	108, 152	28, 048	17, 931	51, 733
British West Indies					310, 194	39, 886	69, 092	16, 311	32, 935	89, 132
British Africa									2, 940	2, 940
Australia, &c									1, 934	1, 934
Spain			32, 570, 783	6, 315, 336						6, 315, 336
Cuba			768	150	111, 287	15, 884	117, 932	35, 136	26, 110	77, 280
Porto Rico					30, 893	3, 606	866	330	677	4, 613
Germany	14, 143	7, 733	42, 502, 461	8, 266, 857	24, 400	4, 000	40, 863	14, 452	2, 295	8, 295, 342
France	257, 323	176, 608	87, 929, 860	16, 719, 027						16, 895, 635
French America							146, 104	28, 567	6, 494	35, 061
Other French possessions					32, 777	5, 338	52, 262	8, 621	566	14, 525
Brazil					869, 363	140, 098	575, 368	99, 411	19, 457	258, 966
China					19, 113	3, 658	674, 823	91, 249	12, 709	107, 616
Argentine Republic							24, 090	6, 958	31, 722	48, 680
Holland			22, 784, 985	4, 409, 612						4, 409, 612
Dutch West Indies					29, 003	3, 657	40, 338	9, 445	7, 477	20, 259
Mexico			957, 209	128, 186	559, 411	84, 387	1, 355, 636	156, 537	38, 368	407, 478
Italy			5, 922, 224	1, 178, 243						1, 178, 243
Venezuela					22, 643	3, 799	55, 165	9, 092	4, 581	17, 472
Belgium			10, 098, 368	1, 967, 366						1, 967, 366
Japan					19, 049	4, 868	12, 515	3, 748	1, 808	10, 424
Colombia					79, 442	9, 977	450, 754	74, 531	4, 759	89, 267
Sandwich Islands					10, 819	2, 017	67, 603	12, 285	2, 498	16, 800
Uruguay							93, 636	21, 812	12, 007	33, 819
Russia			24, 683, 546	5, 218, 526						5, 218, 526
Hayti					340, 211	76, 502	170, 145	40, 719	1, 208	128, 429
San Domingo					94, 572	19, 480	32, 836	7, 285	496	27, 261
Peru					20, 000	3, 722	56, 626	20, 196	5, 913	29, 831
Central America					37, 955	5, 548	18, 212	4, 222	4, 426	14, 196
Chili			4, 459	766	108, 437	14, 873	545, 382	65, 618	1, 500	82, 757
Danish West Indies					18, 146	2, 804	28, 866	10, 258	396	13, 458
Portugal							3, 900	1, 300		1, 300
Portuguese possessions			442	71	1, 148	299	110, 450	12, 682	1, 595	14, 674

Turkey							52,725	8,048	700	8,748
Greece							51,000	6,100		6,100
Liberia					18,249	2,600	3,237	561	280	3,441
Other countries					31,987	4,366	3,421,259	377,620	245	382,231
Total	2,709,106	1,410,303	930,928,307	179,274,292	2,844,888	458,998	8,859,191	1,317,719	527,613	182,988,925

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

Forest products.

	Timber and lumber.	Manufactures of wood.	Bark for tanning.	Pot and pearl ashes.	Rosin and turpentine.	Spirits of turpentine.	Tar and pitch.	Ginseng.	Total.
	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.
England	$1,921,537	$179,966	$74,495	$12,350	$1,225,833	$1,258,404	$41,035		$4,713,620
Scotland	232,557	57,718	19,330		154,231	19,541	8,500		491,877
Ireland	162,136				215,447	593,774			971,357
Gibraltar	46,747	181			55,535	40	88		102,591
Canada	611,299	541,801	417	634	57,469	54,538	38,694		1,304,852
British America	28,801	64,693	181	52	1,160	1,155	5,275		101,317
British West Indies	673,123	82,417	1		835	6,815	5,565		768,756
British Africa	89,891	50,584			9,795	3,243	359		153,872
British East Indies	33,825	1,925			7,614	12,150	1,325		56,839
Australia, &c	165,262	302,216		80	19,997	35,922	314		523,791
Other British possessions									
Spain	837,653	6,246			34,496	615	353		879,363
Cuba	3,063,868	352,868		29	17,024	21,142	8,986		3,463,917
Porto Rico	651,582	42,495		36	98	814	819		695,844
Other Spanish possessions	33,356	1,706			168				35,230
Germany	302,317	126,393	34,334	15,540	786,987	69,199			1,334,770
France	236,551	15,168	30,988	74,844	22,033				379,584
French America	278,785	15,924		31	227	313	777		296,057
Other French possessions	25,880	8,489			45	48	71		34,533
Brazil	252,988	70,256			71,939	18,815	1,012		415,010
China	53,656	54,512			199	2,873	1,966	$340,686	453,892
Argentine Republic	194,028	88,342		250	15,315	34,719	118		332,772
Holland	50,059	1,500	3,494	1,918	145,392	316,761			519,124
Dutch East Indies		855					178		1,033
Dutch West Indies	22,495	13,322			63	103	1,505		37,488
Mexico	103,716	74,920	9	72	2,716	1,676	3,295		186,314
Italy	161,526	411	254		54,099	13,730	54		230,074
Venezuela	6,679	10,175	11	1,820	6,091	688	1,114		26,578
Belgium	88,682	3,411	2,987	306	96,821		43		192,250
Japan	1,723	33,727				142	328	930	36,850
Colombia	66,336	114,583		67	382	1,607	2,065		185,040
Sandwich Islands	82,395	29,692			619	450	225		113,381
Uruguay	409,485	121,612		250	16,207	22,280	54		569,888
Russia	910				75,333				76,243
Hayti	103,780	40,607		43	228	1,029	851		146,538
San Domingo	27,026	20,375			34	53	295		47,783
Peru	781,415	251,788			10,419	8,652	2,930		1,055,204
Central America	43,003	27,031			119	419	1,062		71,634

Chili	151,767	114,125	....	....	2,724	17,007	1,131	....	286,754
Denmark	....	....	....	....	7,568	....	....	....	7,568
Danish West Indies	87,149	24,881	....	152	184	799	222	....	113,387
Portugal	128,454	5,808	....	....	15,132	....	....	....	149,394
Portuguese possessions	41,418	11,662	....	....	....	41	388	....	53,509
Sweden and Norway	....	6	....	....	1,198	....	....	....	1,204
Austria	....	10	....	....	120,478	....	....	....	120,488
Turkey	50	6,226	....	....	4,600	1,800	....	....	12,676
Greece	....	....	....	....	....	....	....	....	....
Liberia	3,331	2,956	....	....	....	....	103	....	6,390
Other countries	8,441	1,607	....	....	....	....	....	....	10,048
Total	12,265,682	2,975,190	166,501	108,474	3,256,854	2,521,357	131,010	341,616	21,766,684

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

Countries.	LIQUORS, FERMENTED, BREWED, AND DISTILLED.						SUGAR AND ITS MANUFACTURES.				
	Wine.	Beer, ale, porter, and cider.	Grain spirits.	Molasses spirits.	All other spirits.	Total.	Brown sugar.	Refined sugar.	Molasses.	Candy, &c.	Total.
	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.	Value.
England	$1, 733		$1, 649			$3, 382		$2, 695	$311, 778	$12	$314, 485
Scotland					$54	54			144, 591		144, 591
Ireland								15	7, 986		8, 001
Gibraltar									20		20
Canada	6, 913	$1, 306	4, 350		24	12, 593	$70	32, 903	1, 269	2, 642	36, 884
British America	690	499	3, 377	$87	469	5, 122	993	25, 431	6, 420	1, 058	33, 902
British West Indies	148	1, 258	2, 329		24	3, 759	284	8, 909	1, 353	3, 145	13, 691
British Africa		228		428, 509		428, 737		581			581
British East Indies											
Australia, &c	384	150	25		81	640					
Spain			220			220		378	19		397
Cuba	729	21, 449	607		15	22, 800		1, 890		7, 063	8, 953
Porto Rico		9				9		128		124	252
Spanish possessions									5		5
Germany	538	40	426			1, 004		110	120, 826	50	120, 986
France	314		1, 829		41	2, 184	7	102	47	5	161
French America		14				14				394	394
French possessions	619	319	447	25, 767		27, 152		5, 714	92	99	5, 905
Brazil			4, 210		2, 266	6, 476		3, 467		61	3, 528
China	89	105	3, 942	280	67	4, 483		5, 389	168	308	5, 865
Argentine Republic			1, 414		3, 739	5, 153		24, 541	971		25, 512
Holland			25			25					
Dutch West Indies								2, 106		102	2, 208
Mexico	4, 393	3, 036	1, 625		340	9, 394	816	29, 635	187	2, 630	33, 268
Italy	280					280		20			20
Venezuela			430		37	467		65	3	375	443
Belgium									3, 000		3, 000
Japan	716	320	3, 023			4, 059		10, 469	1, 503	2, 342	14, 314
Colombia	2, 252	216	696		786	3, 950		148, 600	23	869	149, 492
Sandwich Islands	1, 777	921	8, 776		41	11, 515		661	271	288	1, 220
Uruguay	162	54	1, 345		3, 282	4, 843		39, 553	395		39, 948
Hayti	312	181	84			577		33, 905		79	33, 984

San Domingo	....	275	54	....	....	329	....	9,932	....	75	10,007
Peru	409	1,055	807	....	16,675	17,946	....	7,433	905	50	8,388
Central America	12,624	1,341	966	....	724	15,655	....	4,964	67	633	5,664
Chili	....	....	1,740	1,071	....	2,811	....	144,510	1,048	84	145,642
Danish West Indies	200	168	270	....	....	638	....	254	....	....	254
Portugal	....	....	115	....	....	115	....	....	....	....	....
Portuguese possessions	74	....	....	7,822	....	7,896	....	1,346	....	....	1,346
Turkey	....	....	....	52,454	....	52,454	....	....	....	....	....
Liberia	....	....	....	1,566	....	1,566	....	198	155	....	353
Other countries	2,357	225	497	....	....	3,079	....	15,551	18	....	15,569
Total	37,713	33,169	45,278	517,556	28,665	662,381	2,170	561,455	603,120	22,438	1,189,233

Statement, by countries, showing the values of agricultural products exported from the United States to foreign countries, &c.—Continued.

SEEDS, VEGETABLE OILS, AND OIL-CAKE.

	Cotton-seed.		Flaxseed.		All other seeds.	Castor-seed oil.		Linseed oil.		Volatile or essent'l oils.	Oil-cake.		Total value.
	Bushels.	Value.	Bushels.	Value.	Value.	Gallons.	Value.	Gallons.	Value.	Value.	Pounds.	Value.	
England	4, 606, 451	$48, 831			$1, 675, 737	177, 070	$96, 508			$82, 269	190, 995, 812	$3, 648, 824	$5, 552, 169
Scotland					375, 036	14, 698	8, 593			710	8, 874, 156	152, 054	536, 393
Ireland	1, 682, 710	20, 900			7, 861								28, 761
Gibraltar													
Canada					10, 468	204	159	7, 411	$7, 284	1, 786	224, 575	8, 321	28, 018
British North America					589	2	4	659	685	160	1, 000	18	1, 456
British West Indies			4	$21	2, 494	44	29	1, 220	1, 149	51	6, 763, 253	154, 487	158, 231
British Africa								1, 035	890				890
British East Indies													
Australia					2, 491						38, 199	980	3, 471
Spain						299, 725	159, 323				10, 475	139	159, 462
Cuba	2, 000	15	310	968	5, 644	12	10	838	814	2, 233			9, 684
Porto Rico					84			370	330	101	25	84	599
Spanish possessions													
Germany	400	45	250	750	1, 449, 646	19, 347	10, 458	450	450	128, 286			1, 589, 635
France	2, 000	40			26, 416	35, 143	18, 042			8, 923			53, 421
French America					43			1, 540	1, 366				1, 409
French possessions					143			90	77				220
Brazil	163	23	5	17	34			848	717	2, 064			2, 855
China					333								333
Holland					105, 298					4, 140			109, 438
Dutch West Indies								44	42	100			142
Mexico	66, 360	2, 353	13	50	1, 061	20	20	3, 567	3, 223	153			6, 860
Italy						900	400						400
Venezuela			8	25	2, 320			815	736	896			3, 977
Belgium					70, 913					1, 191			72, 104
Japan					3, 300								3, 300
Colombia	25	5			2, 716			2, 575	2, 536	1, 696			9, 953
Sandwich Islands					545			243	224				769
Uruguay													
Hayti					125			2, 133	2, 103	101			3, 329
San Domingo			3	14	72			450	433				519
Peru					110			305	245	416			771
Central America			3	10	648			1, 069	1, 054	166			1, 878
Chili								2, 380	2, 247	114			2, 361
Denmark					20, 447								20, 447
Danish West Indies			4	12	387			44	40		63, 415	1, 461	1, 900
Portuguese possessions								246	230				230
Turkey													

Liberia								43	39				39
Other countries					64								64
Total	6,360,109	72,212	600	1,867	3,765,025	547,165	293,546	28,375	26,914	235,556	206,970,910	3,966,368	8,361,488

TOBACCO AND MANUFACTURES THEREOF.

Countries.	Leaf.		Cigars.	Snuff.	Other manufactures.	Total.
	Pounds.	Value.	Value.	Value.	Value.	Value.
England	42,421,190	$5,435,399			$1,413,106	$6,848,505
Scotland	2,505,832	332,233			24,257	356,490
Ireland	125,485	11,484			1,983	13,467
Gibraltar	2,259,467	181,276			37,478	218,754
Canada	4,805,494	555,060	$2,595	$1,513	41,149	600,317
British America	61,378	9,194	936		45,169	55,299
British West Indies	1,725,858	217,230		838	58,462	276,530
British Africa	1,565,394	194,862			37,359	232,221
British East Indies					26,692	26,692
Australia, &c	143,257	30,343			314,609	344,952
British possessions	241,596	20,091			382	20,473
Spain	8,887,960	680,261				680,261
Cuba	234,058	43,908		565	46,618	91,091
Porto Rico	23,522	3,734			5,920	9,654
Spanish possessions	31,295	3,178				3,178
Germany	71,073,881	6,960,557	300		63,658	7,024,515
France	38,106,877	3,527,123		7	14,096	3,541,226
French America	1,106,052	99,084		220	23,188	122,492
French possessions	1,155,390	140,234	200		1,716	142,150
Brazil	42,815	5,374	1,370	50	4,345	11,139
China			800		21,617	22,417
Argentine Republic	323,567	46,572			51,274	97,846
Holland	19,165,041	1,515,383			17,892	1,533,275
Dutch East Indies					1,490	1,490
Dutch West Indies	133,856	21,703		1,171	36,907	59,781
Mexico	427,689	66,105		877	4,257	71,239
Italy	23,986,588	2,393,850	20			2,393,870
Venezuela	23,534	4,549			8,871	13,420
Belgium	3,525,721	332,986			25,726	358,712
Japan			130		4,635	4,765
Colombia	206,780	54,159			73,859	128,018
Sandwich Islands			265		18,571	18,836
Uruguay	222,285	29,825			33,857	63,682
Hayti	592,240	86,539			1,389	87,928
San Domingo	8,375	1,213			1,215	2,428
Peru	109,394	21,205			16,168	37,373
Central America	39,397	5,799			4,130	9,929
Chili	395,077	46,479			8,113	54,592
Denmark					613	613
Danish West Indies	84,889	10,665			5,075	15,740
Portugal	3,203,551	301,845			507	302,352
Portuguese possessions	328,427	41,117			6,248	47,365
Austria	5,255,738	658,189				658,189
Turkey					181	181
Liberia	352,845	41,213				41,213
Other countries	45,077	6,145	32		9,084	15,261
Total	234,936,892	24,136,166	6,648	5,241	2,511,866	26,659,921

Agricultural implements.—During the fiscal year ending June 30, 1872, our exports of agricultural implements amounted to $1,647,413, the aggregate of the previous year being $1,070,946. Of fanning-mills we reduced our shipments from 35, valued at $1,390, to 19, valued at $470 Of horse-powers we sent abroad only 11, valued at $3,200, against 26 valued at $10,167, in 1871. Of mowers and reapers we increased our exports from 3,342 to 6,084, and from $354,263 to $714,016. Of plows and cultivators we raised our shipments from 9,586 to 17,395, and from $139,014 to $211,406. Unenumerated articles increased from $566,112 to $618,321. England took 2,042 mowers and reapers and 207 plows and cultivators. Germany took 5 horse-powers, 2,267 mowers and reapers, and 2 plows. Scotland took 886 mowers and reapers and 18 plows and cultivators. The Argentine Republic took 323 mowers and reapers and 2,457 plows and cultivators. Uruguay took 6 fanning-mills, 21 mowers and reapers, and 1,738 plows and cultivators. The following table will exhibit the results of this trade during 1872:

Statement, by countries, showing the export of agricultural implements during the fiscal year ending June 30, 1872.

Countries.	Fanning-mills.		Horse-powers.		Mowers and reapers.		Plows and cultivators.		All others.	Total.
	No.	Value	No.	Value.	No.	Value.	No.	Value.	Value.	Value.
England					2,042	$236,861	207	$2,437	$34,503	$273,801
Scotland					886	76,040	18	319	2,955	79,014
Dominion of Canada	10	$260	4	$1,205	190	18,005	299	5,837	78,534	103,931
Other Br. American poss.	3	110	1	100	135	15,073	98	1,783	31,219	48,285
British West Indies					46	6,275	82	829	3,286	10,920
British Africa							6,209	99,454	35,753	135,207
British East Indies									50	50
Australia, N. Zealand, &c.							50	511	27,180	27,691
Spain					1	125			1,272	1,397
Cuba					8	889	889	1,716	34,823	54,538
Porto Rico							705	8,220	9,128	17,348
Germany			5	1,695	2,267	295,075	2	50	47,637	344,457
France					6	1,000			1,660	2,660
French America					1	110			213	323
Other French possessions									266	266
Brazil							1,047	9,883	37,309	47,192
China									177	177
Argentine Republic					323	41,913	2,457	19,113	42,654	103,780
Holland									2,803	2,803
Dutch W. I. and Guiana							13	148	1,151	1,299
Mexico			1	200	7	890	267	3,475	18,383	22,948
Italy									1,200	1,200
Venezuela							3	38	2,119	2,157
Belgium					1	20			250	270
Japan									81	81
Colombia							44	753	79,384	80,137
Sandwich Islands					1	155	22	434	2,039	2,628
Uruguay	6	100			21	2,445	1,738	14,215	14,472	31,232
Russia					121	13,240				13,240
Peru					2	275	599	5,378	39,834	45,487
Central America					1	225	10	279	2,748	3,252
Chili					25	5,400	1,810	19,464	61,355	86,219
Danish West Indies									1,504	1,504
Portugal							3	50	615	665
Turkey									10	10
Liberia									149	149
All other countries									272	272
Total	19	470	11	3,200	6,084	714,016	17,395	211,406	618,321	1,647,413

MARKET PRICES OF FARM

These quotations represent the state of the market as

Products.	January.	February.	March.	April.	May.
NEW YORK.					
Flour, State .....per bbl.	$5 70 to $6 10	$5 75 to $6 10	$6 10 to $6 50	$6 30 to $6 65	$6 50 to $6 90
extra State........	6 40 to 7 10	6 45 to 7 25	6 70 to 7 50	6 75 to 7 50	7 10 to 8 00
superfine western.	5 70 to 6 10	5 75 to 6 10	6 10 to 6 50	6 30 to 6 65	6 50 to 6 90
extra choice west'n	6 35 to 9 25	6 35 to 9 50	6 70 to 9 50	6 70 to 9 65	7 00 to 12 00
extra southern	6 60 to 7 35	6 75 to 7 35	7 00 to 7 75	7 00 to 7 25	8 00 to 9 75
good to choice southern	7 40 to 9 25	7 40 to 9 50	7 80 to 9 50	7 30 to 9 75	9 80 to 12 25
Wheat, No. 1 spring. bush.	1 58..........	1 56 to 1 58	1 57 to 1 59	1 57 to 1 58	1 65 to 1 66
No. 2 spring......	1 48 to 1 55	1 50 to 1 54	1 52 to 1 56	1 48 to 1 54	1 59 to 1 64½
western, red winter.............	1 56 to 1 60	1 60 to 1 66	1 63 to 1 70	1 69 to 1 73	1 80 to 1 84
western amber winter	1 60 to 1 65	1 65 to 1 72	1 70 to 1 73	1 74 to 1 78	1 87 to 1 92½
western white winter	1 62 to 1 74	1 65 to 1 78	1 72 to 1 80	1 75 to 1 82	1 88 to 2 05
Rye....................	90 to 92	92 to 92½	92 to 93	88 to 88½	92...........
Barley	90 to 1 20	84 to 1 05	80 to 1 14	1 00 to 1 05	67½ to 91
Oats	54 to 56¾	53½ to 55½	52 to 56	53 to 56	52¼ to 56
Corn	76 to 80	73 to 80	70 to 71	70 to 72	73½ to 74
Hay, shipping qual...ton.	27 00 to 28 00	27 00 to 28 00	25 00..........	27 00 to 28 00	29 00 to 30 00
prime, for retailing.	29 00 to 36 00	30 00 to 35 00	27 00 to 32 00	28 00 to 34 00	31 00 to 36 00
Pork, mess...........bbl.	13 00 to 14 50	13 50 to 14 50	13 50 to 14 10	12 80 to 12 87	13 60 to 13 75
prime mess	11 50 to 14 50	11 50 to 14 00	11 50 to 13 87	12 50 to 12 75	13 25 to 13 50
prime..............	12 25..........	12 25..........	12 00..........	10 75..........	11 25..........
Beef, plain mess.........	9 00 to 11 00	9 00 to 11 00	9 00 to 11 00	8 00 to 9 50	8 00 to 9 50
extra mess.........	11 00 to 13 00	11 00 to 13 00	11 00 to 12 50	10 00 to 12 00	10 00 to 12 00
Lard..................lb.	8⅞ to 9⅝	9¼ to 9¾	9¼ to 9¾	8½ to 8⅞	8¾ to 9⅝
Butter, western	12 to 23	12 to 23	12 to 23	12 to 23	20 to 25
State dairy	21 to 35	21 to 37	21 to 37	24 to 49	30 to 31
Cheese, western dairy....	11 to 13	12 to 15	14 to 16	14 to 17	14 to 17
State factory.....	12 to 14	14 to 16	15 to 17½	15 to 19½	15 to 17½
Cotton, ordinary to good ordinary	17 to 19⅞	19¾ to 21¾	19⅜ to 21⅜	20¾ to 22⅞	20 to 22¾
low middling to good middling..	19⅜ to 22⅜	22 to 24	21⅝ to 23⅝	23 to 25	23 to 25
Tobacco, lugs, all grades..	7½ to 8¼	7½ to 8¼	7½ to 8¼	8 to 9¼	8 to 9¼
common to medium leaf	8¼ to 10	8¼ to 10	8¼ to 10	9 to 10¾	9 to 10¾
Wool, pulled, extra.......	60 to 63	71½ to 72½	76 to 82½	....	75 to 80
super.......	64 to 68	71 to 75	70 to 88½	78 to 86	75 to 83
Ohio	64 to 75	76 to 80	80 to 87½	80 to 85	....
Michigan	75..........	75..........	80 to 85	....	....
Texas...............	38 to 40	42..........	....	57 to 60	....
California, fall and spring	42 to 50	38 to 40	39 to 41	37½ to 43	37½.........
BOSTON.					
Flour, western super. bbl.	5 25 to 5 75	5 50 to 5 75	6 00 to 6 25	6 00 to 6 50	.... 6 50
western extra	6 25 to 7 50	6 50 to 9 00	7 00 to 9 50	6 75 to 9 50	7 25 to 10 50
western choice	7 75 to 10 00	8 00 to 10 00	8 50 to 10 50	8 25 to 11 25	9 50 to 12 50
southern extra	6 50 to 7 25	6 75 to 7 00	7 00 to 7 50	7 00 to 7 25	7 25 to 7 50
Baltimore choice ..	9 00 to 10 25	9 00 to 10 25	9 00 to 10 50	9 00 to 11 00	10 00 to 12 50
Wheat.............bush.	1 60 to 1 65	1 60 to 1 65	1 60 to 1 65	1 60 to 1 90	1 75 to 2 10
Rye....................	95..........	90 to 95	90 to 95	92 to 95	92 to 95
Barley	75 to 1 10	75 to 1 10	75 to 1 20	75 to 1 20	75 to 1 20
Corn, southern yellow....	80 to 81	73 to 77	77 to 78	77 to 78	77 to 77½
western mixed	77 to 79	73 to 75	75 to 77	76 to 77	75 to 76
western yellow.....	79 to 81	75 to 77	77 to 78	77 to 79	76½ to 77½
Oats, southern	54 to 60	55 to 60	55 to 60	....	....
western	55 to 61	55 to 60	51 to 61	56 to 62	55 to 61
Beef, mess, western ..bbl.	10 00 to 12 00	10 00 to 12 00	10 00 to 12 00	10 00 to 12 00	10 00 to 12 00
extra, western	12 00 to 16 00	12 00 to 16 00	12 00 to 16 00	12 00 to 16 00	12 00 to 16 00
Pork, prime, western.....	11 50 to 12 50	12 00 to 13 00	12 00 to 12 50	11 00 to 12 50	11 50 to 12 50
mess, western......	15 00 to 15 50	14 75 to 15 00	14 75 to 15 00	14 00 to 14 50	14 25 to 14 75
Lard..................lb.	9½ to 11½	9¼ to 10	9¼ to 10	9 to 9¾	9¼ to 9¾
Butter, New York and Vermont	18 to 33	20 to 35	18 to 35	18 to 35	15 to 31
western	12 to 28	17 to 29	17 to 27	13 to 28	12 to 28
Cheese, New York and Vermont factory...........	12 to 14½	12 to 16	14½ to 17½	16 to 20	16 to 17½
Ohio factory.....	10 to 13½	11 to 15	12 to 16½	14 to 19	15 to 17
Hay, north and east'n. ton.	25 00 to 36 00	22 00 to 34 00	22 00 to 32 00	22 00 to 33 00	28 00 to 38 00
western choice......	31 00 to 33 00	27 00 to 30 00	25 00 to 30 00	25 00 to 29 00	31 00 to 32 00

PRODUCTS DURING 1872.

nearly as practicable at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$6 00 to $6 50	$5 30 to $6 00	$5 55 to $5 90	$5 75 to $6 30	$6 10 to $6 50	$5 80 to $6 20	$5 90 to $6 30
7 00 to 7 90	6 30 to 7 30	6 65 to 7 50	6 90 to 7 80	7 10 to 8 00	6 90 to 7 00	7 00 to 7 80
6 00 to 6 50	5 30 to 6 00	5 55 to 5 90	5 75 to 6 30	6 10 to 6 50	5 80 to 6 20	5 90 to 6 30
6 95 to 12 00	6 15 to 11 75	6 50 to 10 75	6 80 to 10 25	7 10 to 8 30	6 80 to 11 00	6 90 to 11 00
8 25 to 10 75	7 15 to 9 35	7 00 to 8 90	7 25 to 9 50	7 70 to 10 00	7 10 to 9 15	7 10 to 9 15
10 80 to 13 00	9 40 to 12 75	9 05 to 12 00	9 55 to 12 00	10 50 to 12 50	9 20 to 12 00	9 20 to 12 00
.1 74 to 1 76	1 57 to 1 60	1 50 to 1 52	1 62 to 1 63	1 58 to 1 63	1 60 to 1 64	1 60 to 1 61
1 68 to 1 71	1 53 to 1 55	1 47 to 1 49	1 59 to 1 61	1 50 to 1 57	1 50 to 1 59	1 50 to 1 55
1 90 to 2 00	1 63 to 1 67	1 60 to 1 69	1 50 to 1 60	1 63 to 1 73	1 60 to 1 67	1 63 to 1 68
2 05 to 2 08	1 70 to 1 75	1 70 to 1 75	1 60 to 1 70	1 75 to 1 85	1 68 to 1 75	1 70 to 1 77½
2 00 to 2 12	1 68 to 1 80	1 70 to 1 82	1 70 to 1 95	1 70 to 2 02	1 75 to 2 00	1 76 to 2 05
95 to 96	82½........	74..........	75 to 85	80..........	85..........	91..........
1 00..........	Nominal.....	Nominal.....	Nominal....	1 07½........	70 to 85	90 to 1 16
54 to 56	43 to 46	41½ to 47	35 to 49	38 to 45	38 to 48½	49½ to 55
64 to 73	62 to 65	61 to 63¾	63 to 68	64 to 68	59 to 66	63 to 75
32 00 to 33 00	23 00 to 24 00	20 00 to 21 00	19 00 to 21 00	20 00 to 21 00	20 00 to 21 00	22 00..........
34 00 to 38 00	28 00 to 32 00	24 00 to 30 00	26 00 to 29 00	24 00 to 30 00	25 00 to 30 00	28 00 to 36 00
13 15 to 13 25	13 20 to 13 50	13 50 to 13 60	14 10 to 14 25	14 20 to 14 25	15 25 to 15 80	15 75 to 16 00
12 50 to 12 75	12 50 to 12 75	12 00 to 12 25	12 00 to 12 50	13 00 to 13 50	15 00..........	15 25..........
10 50 to 10 75	10 50 to 10 75	10 50 to 11 00	10 50 to 11 00	11 25 to 11 75	....	....
8 00 to 9 50	8 00 to 9 50	5 00 to 8 00	5 00 to 7 00	5 00 to 7 00	4 00 to 8 50	4 00 to 12 00
10 00 to 12 00	10 00 to 12 00	7 00 to 10 00	7 00 to 9 00	8 00 to 10 00	8 50 to 10 00	8 50 to 13 50
8¾ to 9⅜	8½ to 9⅝	8 to 9¼	8¼ to 9¼	8½ to 9⅜	8⅛ to 8⅞	7¾ to 8⅝
15 to 25	11 to 16	11 to 16	10 to 15	10 to 22	10 to 23	10 to 22
27 to 30	23 to 28	20 to 26	20 to 26	20 to 32	24 to 35	24 to 35
10 to 13	7 to 11½	9 to 12	12 to 13½	11 to 13	12½ to 13¾	12½ to 13¾
13 to 14¾	7 to 12⅛	11 to 13	13 to 14½	11½ to 14	12 to 15	12 to 14½
20¾ to 23⅞	20½ to 23⅜	16 to 17⅜	17 to 20⅛	15⅝ to 18¼	16½ to 19½	16¼ to 18⅞
25⅜ to 27¾	24¼ to 27¼	20¼ to 23⅜	21 to 24½	18⅝ to 20¼	19¼ to 21½	18⅝ to 21
8¼ to 9½	8½ to 9½	8½ to 9½	9 to 10½	9¼ to 10¼	9¼ to 10¼	9¼ to 10¼
9 to 10¾	9 to 10¾	9¼ to 10¾	10 to 11½	10 to 11¾	10 to 11¼	10 to 11¼
70 to 76	60 to 62½	....	....	54..........	57½..........	40 to 45
75 to 82	65 to 75	61 to 65	63 to 70	54..........	49 to 57½	55 to 68
76..........	....	62½ to 65	....	....	58¼..........	....
....	....	58 to 60	....	55 to 58	55 to 57	....
....	44 to 54	45 to 50	35 to 48	35..........	23 to 38	40 to 45
30..........	22½ to 25	30 to 33	26 to 27	....	26..........	28..........
6 50 to 7 00	5 00 to 5 50	5 00 to 5 50	5 50 to 5 75	5 25 to 6 00	5 50 to 6 00	5 50 to 6 00
7 25 to 11 50	6 25 to 9 00	6 25 to 9 50	6 75 to 9 00	7 00 to 10 00	6 50 to 9 50	6 75 to 9 50
10 50 to 12 50	9 00 to 11 50	8 50 to 11 50	8 50 to 11 00	9 00 to 12 00	8 75 to 11 50	9 00 to 11 50
8 00 to 8 25	6 50 to 7 00	6 25 to 7 00	6 75 to 7 25	7 00 to 7 50	6 75 to 7 25	6 75 to 7 25
11 00 to 13 00	9 50 to 11 50	10 00 to 11 50	9 50 to 12 00	10 00 to 12 00	10 00 to 12 00	10 00 to 12 00
1 85 to 2 50	1 55 to 1 80	1 60 to 1 80	1 50 to 1 85	1 60 to 2 00	1 60 to 2 00	1 60 to 2 00
92 to 95	95 to 1 00	85 to 90	85 to 90	85 to 90	85 to 90	.........1 00
75 to 1 20	75 to 20	75 to 1 10	75 to 1 10	75 to 1 10	75 to 1 10	90 to 1 20
76 to 77	68 to 69	70 to 71	70 to 71	74 to 75	71 to 72	72 to 73
74 to 76	65 to 67	67 to 69	67 to 69	71 to 72	69 to 71	70 to 72
76 to 7[illegible]	68 to 9	70 to 71	70 to 71	74 to 75	71 to 72	72 to 73
....	....	....	....	....	....	....
59 to 65	43 to 50	40 to 52	45 to 57	38 to 60	40 to 56	45 to 56
10 00 to 12 00	10 00 to 12 00	10 00 to 12 00	10 00 to 11 00	10 00 to 11 00	11,00 to 12 00	13 00 to 13 50
12 00 to 16 00	12 00 to 16 00	12 00 to 16 00	11 00 to 15 50	11 00 to 16 00	11 00 to 16 00	11 00 to 17 00
11 50 to 12 50	11 50 to 12 50	11 25 to 12 00	11 25 to 12 00	11 25 to 12 00	12 00 to 12 50	12 50 to 13 00
14 25 to 14 75	14 00 o 14 50	14 00 to 14 50	14 75 to 15 00	15 75 to 16 00	16 00 to 16 50	16 50 to 17 00
9⅛ to 10	9 10	9 to 10	9 to 10	9 to 10	9 to 10	9 to 9½
18 to 30	20 25	18 to 27	15 to 28	15 to 28	15 to 34	15 to 33
12 to 37	15 22	12 to 23	12 to 23	12 to 23	15 to 30	12 to 30
13 to 14	12½	10 to 12½	11 to 14	11 to 14½	13 to 15½	12 to 14½
13 to 14	10½	10 to 11½	11½ to 13½	11 to 14	12½ to 15	12 to 14½
23 00 to 41 00	25 00 35 00	25 00 to 31 00	25 00 to 31 00	20 00 to 29 00	20 00 to 28 00	20 00 to 28 00
32 00 to 35 00	25 00 to 30 00	20 00 to 24 00	20 00 to 23 00	....	....	....

MARKET PRICES OF FARM

The following quotations represent the state of

Products.	January.	February.	March.	April.	May.
BOSTON—Continued.					
Cotton, ordinary to good ordinary....lb.	$0 17½ to 19½	$0 19¼ to 21¾	$0 19½ to 21½	$0 20½ to 22¼	$0 20½ to 23
low middling to good middling..	19¾ to 22	22 to 24	22 to 24	22½ to 24½	23¼ to 25
Tobacco, common to medium leaf.....	10 to 11	10 to 11	10 to 11	10 to 11	10 to 11
lugs............	8½ to 9½	8½ to 9½	8½ to 9½	8½ to 9½	8½ to 9½
Wool, Ohio and Pennsylvania............	62 to 75	65 to 80	75 to 90	75 to 90	75 to 85
Michigan..........	60 to 70	65 to 75	70 to 82	75 to 90	75 to 80
other western.....	60 to 66	65 to 74	70 to 80	75 to 82	73 to 78
California.........	35 to 55	30 to 55	35 to 55	35 to 55	35 to 55
Texas.............	30 to 47½	30 to 50	35 to 50	35 to 50	35 to 50
combing fleece.....	70 to 74	80	85 to 90	92 to 95	90 to 95
pulled............	40 to 80	55 to 85	60 to 1 00	60 to 1 00	55 to 95
BALTIMORE.					
Flour, superfine, city.bbl.	6 00 to 7 25	6 00 to 7 25	6 25 to 8 00	6 75 to 8 00	7 00 to 8 75
western	5 75 to 6 25	6 00 to 6 50	6 25 to 6 50	6 75 to 7 25	7 00 to 7 50
extra shipp'g, city.	6 62 to 7 75	6 62 to 7 75	7 12 to 8 25	7 37 to 8 75	8 00 to 9 50
extra shipp'g, western	6 62 to 7 00	6 62 to 7 60	7 12 to 7 37	7 37 to 7 62	8 00 to 8 25
Baltimore family..	10 50	10 50	11 25	11 25	12 50 ....
Wheat, choice, white. bush	1 70 to 1 90	1 80 to 1 90	1 90 to 2 00	1 90 to 2 00	2 15 to 2 20
amber, good to choice.........	1 70 to 1 80	1 70 to 1 80	1 80 to 1 90	1 90 to 2 00	2 10 to 2 15
red, good to prime	1 55 to 1 65	1 60 to 1 70	1 65 to 1 75	1 80 to 1 85	1 95 to 2 05
Corn, white.............	67 to 71	65 to 70	64 to 66	64 to 66	72 to 73
yellow.............	67 to 71	67 to 70	63 to 64	66 to 67	69 to 70
Rye....................	92 to 1 00	1 00 to 1 02	90 to 1 00	90 to 1 05	95 to 1 05
Oats...................	53 to 58	53 to 56	51 to 56	52 to 59	53 to 58
Hay, western........ton.	33 50	....	....	....	35 00 ....
eastern............	30 00 to 33 00	25 00 to 27 00	28 00 to 30 00	28 00 to 32 00	35 00 ....
Pork, mess............bbl.	14 75 to 15 00	14 50	13 75 to 14 25	13 25 to 13 50	14 00 to 14 25
Beef, Baltimore mess.....	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00
extra..............	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00
Lard..................lb.	9¾ to 11	10¼ to 11½	9¼ to 9¼	8¾ to 9½	8¾ to 9½
Butter, Glades...........	15 to 25	20 to 24	20 to 24	20 to 24	20 to 24
western.........	12 to 24	12 to 24	20 to 26	26 to 31	23 to 30
Goshen..........	30 to 34	30 to 40	30 to 35	30 to 41	30 to 35
Cheese, western..........	13½ to 14½	14 to 15	16 to 16½	....	15 to 16
eastern..........	14½ to 15	15½ to 16	16½ to 17	18½ to 19	18 to 18½
Cotton, ordinary to good ordinary.......	16 to 19	............21½	20 to 21½	20½ to 21¾	20 to 21¾
low middling to middling.......	19¾ to 20¼	22 to 22¼	21½ to 22½	22½ to 23⅝	22¾ to 23⅝
Tobacco, lugs, Virginia and Ky. cent'l.	6 00 to 8 50	7 00 to 8 50	7 00 to 8 50	7 00 to 8 50	7 00 to 8 00
common to medium, leaf....	8 00 to 9 25	8 00 to 9 25	8 00 to 9 25	8 00 to 9 25	8 00 to 9 25
Wool, fleece, common to fine..........lb.	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50
unwashed, free from burs...........	40 to 43	44 to 46	44 to 46	47 to 50	47 to 50
tub-washed.........	58 to 63	68 to 70	68 to 70	80 to 83	80 to 83
pulled.............	41 to 46	41 to 46	41 to 46	65 to 70	65 to 70
CINCINNATI.					
Flour, superfine......bbl.	5 75 to 6 00	6 00 to 6 25	6 50 to 6 75	6 25 to 6 65	6 75 to 7 25
extra..............	6 50 to 6 65	7 00 to 7 50	7 10 to 7 25	7 25 to 7 50	7 15 to 8 35
family and fancy..	6 65 to 6 85	7 15 to 7 35	7 35 to 7 55	7 50 to 7 75	8 35 to 8 50
Wheat, white, No. 1. bush.	1 55 to 1 60	1 60 to 1 65	1 68 to 1 70	1 80	2 00 to 2 05
red, No. 1.........	1 48	1 55 to 1 57	1 60 to 1 62	1 68 to 1 70	1 88 ....
hill...............	....	....	....	..........1 75	1 90 to 1 95
Corn....................	47 to 50	47 to 51	45 to 48	46½ to 48	45 ....
Oats....................	36 to 40	41 to 45	41 to 45	38 to 40	42 to 43
Rye.....................	81 to 82	89 to 92	90 to 93	90 to 92	92 to 94
Barley..................	65 to 85	70 to 90	60 to 80	60 to 78	55 to 75
Hay, common.........ton.	12 00 to 14 00	12 00 to 14 00	15 00 to 17 00	16 00 to 18 00	18 00 to 22 00
prime to choice.....	14 00 to 24 00	14 00 to 25 00	16 00 to 25 00	18 00 to 24 00	22 00 to 30 00
Pork, mess............bbl.	13 50	13 25	12 50 to 13 75	11 75 to 12 00	13 00 to 14 00
Beef, mess............bbl.	13 00 to 13 50	12 50	13 00 to 14 00	13 00 to 13 50	12 75 to 13 60
Lard..................lb.	8⅝ to 10¼	8¼ to 10¼	8¼ to 10	8⅛ to 9¼	8⅛ to 10
Butter, Western Reserve.	23 to 25	23 to 25	24 to 26	28 to 30	28 to 30
Central Ohio.....	15 to 22	12 to 22	16 to 23	16 to 27	16 to 28
Cheese, factory..........	14½ to 15	15 to 16	16½ to 17½	18 to 19	14 to 15

PRODUCTS FOR 1872.

the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$0 20½ to 24¼	$0 20½ to 24	$0 16 to 19½	$0 17 to 21	$0 15½ to 18½	$0 17½ to 20	$0 16½ to 17
25 to 27	25 to 27½	20½ to 24	21½ to 24½	18½ to 21	20 to 23	19 to 23
10 to 11	10 to 11	10 to 11	10 to 12	10 to 12	10 to 12	11 to 12
8½ to 9½	8½ to 9½	9 to 9¾	9 to 9¾	9 to 9¾	9 to 9¾	10 to 10½
68 to 78	65 to 75	60 to 72	58 to 70	53 to 68	55 to 70	65 to 80
65 to 73	62 to 70	58 to 65	57 to 62	52 to 58	55 to 60	63 to 70
65 to 72½	62 to 67	57 to 65	55 to 60	52 to 57	53 to 59	63 to 70
30 to 60	25 to 57	25 to 55	25 to 32	20 to 45	20 to 45	32 to 52½
35 to 50	35 to 50	35 to 50	35 to 50	35 to 45	35 to 45	45 to 55
88 to 90	75 to 80	70 to 75	70 to 75	67 to 70	65 to 70	78 to 80
55 to 85	45 to 80	45 to 72	40 to 70	30 to 60	30 to 62	45 to 75
7 50 to 9 25	5 00 to 9 25	4 50 to 9 25	5 00 to 8 75	5 00 to 8 75	5 50 to 8 75	5 25 to 8 50
7 50 to 8 00	5 00 to 6 00	4 50 to 5 50	5 00 to 6 00	5 00 to 6 25	5 50 to 6 50	5 25 to 6 50
8 50 to 11 00	6 50 to 9 50	5 75 to 9 00	6 50 to 9 50	6 50 to 9 25	6 50 to 9 25	6 50 to 9 50
8 50 to 8 75	6 50 to 7 00	5 75 to 6 25	6 50 to 7 25	6 50 to 7 25	6 50 to 7 25	6 50 to 7 25
13 50	12 50	12 50	12 00	12 00	12 00	12 00 ....
2 10 to 2 15	1 55 to 1 63	1 68 to 1 75	1 85 to 1 90	2 00 to 2 07	2 00 to 2 05	2 05 to 2 10
2 05 to 2 10	1 55 to 1 60	1 65 to 1 72	1 85 to 1 88	1 95 to 2 00	1 95 to 2 05	1 85 to 2 05
1 90 to 2 00	1 40 to 1 50	1 55 to 1 63	1 70 to 1 80	1 75 to 1 90	1 80 to 1 90	1 80 to 1 95
77 to 78	78 to 80	75 to 77	65 to 68	72 to 74	60 to 68	58 to 63
73 to 76	62	62 to 63	64 to 65	67 to 68	58 to 60	57 to 59
98 to 1 05	90 to 1 00	60 to 70	75 to 85	70 to 80	80 to 85	80 to 90
55 to 62	43 to 48	40 to 47	37 to 40	40 to 45	39 to 43	43 to 48
34 00 to 35 00	33 00 to 36 00	34 00 to 35 00	34 00 to 38 00	30 00 to 33 00	28 00 to 32 00	30 00 to 36 00
35 00 to 37 00	33 00 to 36 00	....	40 00 to 42 00	....	....	35 00 ....
14 00 to 14 25	13 50 to 13 75	14 00 to 14 50	15 00	15 00	16 00	15 00 to 15 50
15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 20 00
23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00	23 00 to 25 00
8¾ to 9½	8¾ to 9½	8¾ to 9½	8¾ to 9½	8¾ to 9	8½ to 8¾	8½ to 8¾
25 to 30	20 to 25	20 to 25	20 to 26	20 to 24	20 to 24	20 to 26
23 to 30	13 to 16	17 to 22	14 to 22	20 to 25	20 to 25	18 to 28
30 to 33	25 to 30	25 to 30	20 to 26	....	....	34 to 37
13 to 14½	12 to 13½	11 to 12½	14 to 15	15 to 15½	14½ to 15	14½ to 15
16 to 16½	15½ to 16	15½ to 16	....	14 to 15½	14½ to 15½	14½ to 15½
19¼ to 22¼	20 to 23½	18 to 19½	18 to 20½	.... 17⅞	.... 18⅝	.... 18¼
23⅝ to 24½	24½ to 25½	20½ to 21½	21 to 22½	18 to 18½	19⅛ to 19⅝	18¾ to 19⅛
7 00 to 9 00	7 50 to 9 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00
9 00 to 10 00	9 00 to 10 00	10 50 to 12 00	10 50 to 12 00	10 50 to 12 00	10 50 to 12 00	10 50 to 12 00
45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50
45 to 46	40 to 42	40 to 42	33 to 36	29 to 32	30	36 to 38
70 to 75	68 to 70	60 to 62	55 to 57	49 to 51	45 to 48	55 to 60
....	....	....	45	37	38	35 to 42
6 65 to 7 25	5 25 to 5 75	5 25 to 5 75	5 75 to 6 50	5 25 to 6 00	5 00 to 5 75	5 25 to 6 00
8 35 to 8 50	6 75 to 7 00	7 75 to 7 85	7 35 to 7 50	7 25 to 7 50	6 75 to 7 00	7 25 to 7 40
8 50 to 8 75	7 00 to 7 25	8 00 to 8 25	7 60 to 8 75	7 50 to 8 75	7 00 to 9 00	7 40 to 9 00
2 00 to 2 05	....	1 55 to 1 60	1 65 to 1 70	1 65 to 1 75	1 63 to 1 70	1 68 to 1 75
1 90	1 50	1 60 to 1 63	1 50 to 1 55	1 55 to 1 75	1 55	1 56 to 1 58
1 95 to 2 00	1 90	1 45 to 1 50	1 57 to 1 60	1 60 to 1 65	1 60 to 1 65	1 60 to 1 65
53 to 54	49 to 54	45 to 56	46 to 48	45	37 to 42	40 to 44
42 to 46	30 to 36	27 to 36	25 to 32	27 to 36	25 to 33	25 to 34
90 to 98	66 to 68	60 to 80	65 to 73	67 to 72	55 to 70	63 to 72
55 to 75	54 to 70	54 to 70	65 to 90	60 to 97	50 to 90	78 to 90
20 00 to 21 00	16 00 to 18 00	15 00 to 18 00	13 00 to 17 00	14 00 to 18 00	14 00 to 18 00	15 00 to 17 00
22 00 to 27 00	20 00 to 23 00	20 00 to 24 00	18 00 to 20 00	19 00 to 21 00	18 00 to 21 00	18 00 to 21 00
15 00	12 00 to 14 75	13 25 to 13 70	13 25 to 13 75	14 25 to 14 50	14 25 to 14 50	12 00 ....
12 25	11 00 to 11 50	11 00 to 11 50	9 50 to 10 00	....	12 75 to 13 00	....
8¼ to 8¾	7¾ to 11¾	7⅝ to 10	8 to 8⅞	7½ to 8¼	7⅝ to 8	7¼ to 9½
20 to 22	18 to 20	20 to 22	20 to 22	23 to 25	23 to 25	25 to 28
14 to 20	12 to 17	12 to 20	8 to 21	13 to 23	13 to 22	16 to 25
12½ to 13	10 to 10½	12 to 12½	14½ to 15½	14½ to 15½	15 to 16	14½ to 15½

MARKET PRICES OF FARM

The following quotations represent the state of

Products.	January.	February.	March.	April.	May.
CINCINNATI—Continued.					
Cotton, ordinary to good ordinary ....lb.	$0 16½	.......$0 21	$0 19½ to $0 20½	$0 20 to $0 21¼	$0 19¼ to $0 21½
low middling to good middling..	18⅝ to $0 20	$0 21½ to 23	21¼ to 22½	22 to 23	22¼ to 23⅜
Tobacco, lugs .....cental.	5 00 to 13 00	7 00 to 18 00	8 00 to 18 00	8 to 18 00	8 00 to 18 00
leaf	8 00 to 16 00	8 00 to 30 00	9 00 to 30 00	9 00 to 25 00	9 00 to 25 00
Wool, tub-washed .....lb.	65 to 70	70 to 75	75 to 78	75 to 78	70
fleece washed	50 to 55	50 to 55	55 to 60	55 to 60	60 to 70
unwashed, man'f't'g	42 to 45	42 to 45	45 to 48	45 to 48	45 to 48
combing.	42 to 45	42 to 45	40 to 45	45 to 50	50 to 55
pulled	52 to 56	60 to 62	72 to 75	68 to 70	65 to 68
CHICAGO.					
Flour, winter, extra..bbl.	7 60 to 8 25	8 25 to 8 50	7 25 to 9 00	8 50 to 9 00	9 00
spring, extra......	5 00 to 6 00	6 12½ to 7 00	5 50 to 6 75	5 25 to 7 00	7 00 to 7 25
Wheat, spring, No. 1.bsh	1 22½ to 1 23½	1 28½ to 1 29	1 31..........	1 28 to 1 30	....
spring, No. 2....	1 19⅜ to 1 21¼	1 23¼ to 1 23⅞	1 23¾ to 1 25	1 20 to 1 21	1 35¾ to 1 37¼
spring, No. 3.....	1 09 to 1 10¾	1 13¼ to 1 14	1 18..........	1 15 to 1 16	....
Corn, No. 2.............	40⅛ to 40⅞	40⅞ to 41⅛	37 to 39¼	38 to 38¼	42⅞ to 43½
rejected	37¾ to 38	37 to 37¾	....	....	41 ....
Oats, No. 2	31⅝ to 32⅛	32¼ to 32¾	31⅝ to 32	30⅝ to 30¾	35⅝ to 36
rejected	28 to 29	29..........	29..........	....	....
Rye, No. 2	63 to 63½	68¾ to 69½	73 to 74½	68 to 70	75½ to 77
Barley, No. 2...........	60½ to 61½	60½........	56 to 57¼	50..........	57 to 57½
Hay, timothy ....ton.	12 00 to 15 00	12 00 to 15 00	11 00 to 14 00	10 00 to 14 00	16 00 to 20 00
prairie............	9 00 to 11 00	9 00 to 11 00	8 50 to 10 50	8 00 to 10 00	11 00 to 12 50
Pork, mess ....lb.	13 00 to 13 25	12 65 to 12 70	11 95 to 12 20	11 30 to 11 35	12 60 to 12 65
prime mess	....	11 50..........	11 40 to 11 50	....	11 50 to 12 00
Beef, mess	8 00 to 8 25	8 00 to 8 25	8 75 to 9 00	8 75 to 9 00	9 00..........
extra	10 00..........	10 00..........	10 75 to 11 00	10 75 to 11 00	10 00..........
Lard ....lb.	8 to 8⅝	8 to 9	8⅝ to 8⅞	8 1-6 to 8 1-5	8¾..........
Butter, choice............	20 to 25	22 to 25	25 to 27	25 to 27	26 to 28
fair to good	14 to 17	13 to 16	16 to 22	16 to 22	17 to 21
Cheese, New York fact'y.	15½ to 16	15..........	17 to 17½	20 to 21	14 to 19
Ohio factory	14 to 15	13..........	16..........	18 to 19	13 to 14
western factory..	13 to 15	12 to 13	13 to 16	15 to 18	13 to 14
Wool, fleece-washed......	58 to 62	58 to 62	58 to 66	58 to 68	58 to 68
tub-washed........	50 to 75	50 to 76	60 to 82	63 to 85	62 to 80
unwashed	30 to 45	30 to 45	36 to 50	34 to 50	36 to 50
pulled	....	....	....	....	....
SAINT LOUIS.					
Flour, superfine .....bbl.	5 40 to 5 60	5 50 to 5 75	5 50 to 5 80	5 40 to 5 80	5 40 to 5 60
extra..............	6 25 to 6 60	6 50 to 6 65	6 60 to 6 75	6 50 to 7 10	6 50 to 7 16
fancy	8 00 to 8 75	8 50 to 9 50	9 00 to 10 00	9 50 to 10 00	10 00 to 11 25
Wheat, winter, No. 1.bsh	1 55 to 1 60	1 65 to 1 72	1 82 to 1 85	1 90 to 1 95	2 00 to 2 10
winter, No. 3.....	1 43 to 1 48	1 55 to 1 62	1 75 to 1 80	1 78 to 1 82½	1 90 to 1 95
spring, No. 2.....	1 25 to 1 30	1 26 to 1 32	1 37½ to 1 42	1 35 to 1 42	1 40 to 1 50
Corn, white..............	42 to 43½	46½ to 47	44 to 45	45 to 47½	46 to 48½
yellow	41 to 42½	42 to 43½	40 to 42	39 to 41	44 to 46
Barley..................	75 to 82½	75 to 85	70 to 85	75 to 85	75 to 85
Rye.....................	73 to 79½	75 to 80	80 to 83	75 to 82	78 to 84
Oats	34 to 37½	35 to 42	35 to 38½	35 to 38	37½ to 42
Hay, prime to choice.ton.	16 00 to 18 50	17 00 to 20 00	20 00 to 23 00	18 00 to 22 00	19 00 to 23 50
Pork, mess ....bbl.	13 25 to 13 75	13 00 to 13 62½	12 75 to 13 25	11 75 to 12 25	12 00 to 12 50
Lard ....lb.	8¼ to 9	8 to 9	8¼ to 9⅓	8 to 9½	8¼ to 9¾
Butter, good to choice....	23 to 26	19 to 33	19 to 37	20 to 40	18 to 25
Cheese, choice factory....	14½ to 15	14½ to 15	16½ to 17	18½ to 22	17 to 19
Cotton..................	18 to 20	20⅝ to 21⅝	20 to 21	21½ to 22¼	22¼ to 22½
Tobacco, fact'y lugs.cental	6 75 to 7 75	6 75 to 7 75	5 75 to 6 10	6 80 to 7 25	7 10 to 7 50
common leaf.....	9 00 to 12 00	9 00 to 12 00	8 00 to 12 00	8 25 to 8 75	8 00 to 8 75
Wool, tub-washed.....lb	73 to 75	78 to 80	80 to 85	75 to 80	68 to 75
unwashed	40 to 47	46 to 50	47½ to 50	45 to 50	43 to 50
NEW ORLEANS.					
Flour, superfine .....bbl.	7 00 to 7 25	6 75 to 7 00	6 62½..........	6 50..........	6 25..........
extra..............	7 25 to 8 25	7 37½ to 8 25	7 25 to 8 75	7 25 to 8 75	6 50 to 9 25
choice and family.	8 50 to 9 25	8 75 to 9 75	9 00 to 11 50	9 00 to 11 00	9 50 to 12 00
Corn, white ....bush.	73 to 78	85 to 90	80 to 85	74 to 80	72 to 73
yellow............	73 to 78	80 to 85	73 to 78	72 to 75	70 to 72

PRODUCTS FOR 1872.

the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$0 20½ to $0 23½	$0 19 to $0 22	$0 16¼ to $0 18½	$0 16½ to $0 18¾	$0 15¼ to $0 17¼	$0 16 to $0 17⅞	$0 15¾ to $0 17⅜
23 to 27	23¼ to 26	20½ to 23½	20½ to 23½	18¼ to 19¼	18⅜ to 19½	18 to 19½
8 00 to 18 00	10 00 to 18 00	10 00 to 18 00	....	....	....	....
9 00 to 25 00	12 00 to 25 00	12 00 to 25 00	....	....	....	....
65 to 68	65 to 67	60 to 65	58 to 62	50 to 55	50 to 55	60 to 62
60 to 70	55 to 70	55 to 65	48 to 52	47 to 50	47 to 50	53 to 62
40 to 45	40 to 45	40 to 45	36 to 40	30 to 35	30 to 35	36 to 38
50 to 55	50 to 55	50	46 to 48	46 to 48	46 to 48	45 to 48
60 to 65	55 to 60	53 to 55	37 to 42	35 to 37	35 to 37	43 to 45
8 25 to 10 50	9.50	8 25 to 10 00	6 75 to 9 00	.... 9 50	8 50 to 10 00	6 50 to 9 75
7 00 to 8 25	6 75 to 7 37½	6 00 to 7 75	5 75 to 8 00	6 00 to 7 25	4 75 to 6 75	6 00 to 7 25
1 51	1 25 to 1 26	1 31 to 1 33	1 23 to 1 24	1 24 to 1 25	1 17	1 18 ....
1 43 to 1 46	1 20 to 1 21¾	1 31 to 1 32	1 18¼ to 1 19	1 18½ to 1 20	1 07½ to 1 08	1 08⅝ to 1 09¼
1 38 to 1 39	1 10 to 1 12	1 14 to 1 14¼	1 10 to 1 10½	1 07 to 1 08	96 to 97½	99 to 1 00
42⅜ to 44½	40¼ to 41⅛	42 to 42¾	38¼ to 39¼	35½ to 36⅛	31¼ to 31¾	31⅛ to 31½
40 to 41	37	39 to 39½	36	34	30 to 30½	29 to 30
40¾ to 41⅛	26¼ to 27¼	27 to 27½	26½	22¼ to 23½	20⅝ to 21⅜	24 to 24¾
37	25	25	....	20 to 22¼	17 to 17½	22⅛ to 23
75 to 76	56⅛	60½ to 61	57½ to 58	55	51½	57 to 57½
56 to 60	50 to 52	50 to 55	65½ to 70	65½ to 66	62½ to 64½	60 to 64
17 00 to 22 00	14 00 to 16 00	13 00 to 16 50	14 00 to 19 00	14 00 to 17 00	15 00 to 17 00	15 00 to 17 50
10 00 to 13 00	9 00 to 11 00	9 00 to 11 00	9 00 to 11 00	9 00 to 11 50	9 00 to 11 00	9 50 to 12 50
11 95 to 12 00	12 47½ to 12 50	14 00 to 14 02½	14 75 to 14 80	14 25 to 14 50	14 00 to 15 00	12 25 to 14 75
....	....	....	....	....	....	11 50 ....
9 00	9 00	9 00	9 00	9 00	8 00 to 8 50	8 50 to 9 00
10 00	10 00	10 00	10 00	10 00	9 00 to 10 00	9 50 to 10 00
8 to 8⅝	7¾ to 8¾	8½ to 8¾	8⅝ to 8⅝	8¾ to 8⅞	7⅝	7¼ to 7⅝
18 to 20	15 to 17	18 to 22	21 to 25	25 to 28	25 to 26	24 to 28
14 to 18	12 to 14	13 to 15	14 to 18	16 to 22	18 to 22	18 to 22
14 to 15	12 to 13	11 to 12	13 to 14	14½ to 15½	15 to 16	14 to 15
12 to 14	10 to 11	9 to 10½	11 to 12½	13 to 14	13½ to 14½	12 to 13½
12 to 14	10 to 11	9 to 10½	10½ to 12½	13 to 14	13 to 14½	12 to 13½
58 to 68	57 to 63	52 to 57	43 to 58	42 to 54	30 to 52	45 to 57
62 to 80	60 to 73	60 to 70	60 to 67	57 to 64	50 to 60	55 to 68
46 to 50	38 to 45	35 to 43	33 to 43	30 to 37	28 to 35	32 to 42
....	....	....	50 to 55	44 to 47	40 to 45	40 to 50
5 50 to 5 75	3 75 to 4 50	4 50 to 5 00	4 25 to 4 75	5 25 to 5 85	4 25 to 5 00	4 50 to 5 00
7 00 to 7 50	5 75 to 6 25	6 25 to 6 60	6 00 to 6 65	6 50 to 6 85	5 75 to 6 75	5 75 to 6 50
10 50 to 11 50	9 00 to 10 00	9 75 to 10 50	8 50 to 10 00	9 00 to 10 00	9 00 to 9 50	9 50 to 10 50
2 10 to 2 15	1 70 to 1 80	1 62 to 1 65	1 70 to 1 80	1 80 to 1 85	1 80 to 1 82½	1 90 to 1 95
1 98 to 2 00	1 65 to 1 72	1 40 to 1 52	1 57 to 1 65	1 65 to 1 70	1 60 to 1 65	1 65 to 1 70
1 45 to 1 50	.... 1 15	1 25 to 1 30	1 20 to 1 25	1 20 to 1 25	1 11 to 1 15	1 16 to 1 20
44 to 56	50 to 52	53 to 55	40 to 42	40 to 42	43 to 44	36½ to 39½
47 to 50½	42 to 44	38½ to 40	35 to 35½	37½ to 40	30 to 34	28 to 32
70 to 75	55 to 60	40 to 50	60 to 80	70 to 95	70 to 90	75 to 95
80 to 90	58 to 62	58 to 60	56 to 62	60 to 70	53 to 55	57 to 62
39 to 42	27 to 35⅓	25 to 33	20 to 28½	26 to 30	23 to 27	23 to 30
19 00 to 23 00	17 00 to 22 00	17 50 to 22 00	17 00 to 20 00	17 00 to 20 00	18 00 to 22 00	18 00 to 20 00
12 25 to 12 75	11 75 to 12 25	13 50 to 14 00	14 75 to 15 00	14 50 to 15 00	12 75 to 16 50	12 00 to 13 00
8½ to 10½	8 to 10	8 to 10	8 to 10½	8¼ to 10½	8½ to 10	7 to 9¼
16 to 20	15 to 19	16 to 24	16 to 30	20 to 33	18 to 30	20 to 29
13 to 13½	11½ to 12½	10½ to 11	12½ to 13½	14¼ to 15¼	15½ to 16	14¾ to 15
23½ to 25¼	24 to 25	21½ to 22	21½ to 22	18 to 18½	18½ to 19	18 to 18½
7 50 to 7 75	7 50 to 7 80	7 50 to 7 80	8 00 to 8 50	7 75 to 8 50	7 75 to 8 00	7 75 to 8 00
8 25 to 9 75	8 25 to 9 00	8 50 to 9 50	9 00 to 9 75	9 00 to 9 75	8 50 to 9 00	8 50 to 9 00
65 to 71½	65 to 71	55 to 60	53 to 55	56 to 58	50 to 56	65 to 68
45 to 53	46 to 55	41 to 43	33 to 37	34 to 37	28 to 32	35 to 43
6 62½	6 00 to 6 75	5 25 to 5 50	5 75 to 6 00	5 00 to 6 00	5 25	5 37½ ....
6 75 to 9 00	6 75 to 8 25	5 75 to 7 25	6 40 to 7 50	7 00 to 8 50	6 00 to 7 50	5 50 to 7 37½
9 50 to 12 00	8 75 to 10 50	7 25 to 9 50	7 75 to 10 00	8 75 to 11 00	7 75 to 10 00	7 50 to 10 50
72 to 75	68 to 73	67 to 68	60 to 62	65	70	62 to 65
72 to 74	....	57 to 58	56	63	68	60 to 62

MARKET PRICES OF FARM

The following quotations represent the state of

Products.	January.	February.	March.	April.	May.
NEW ORLEANS—Cont'd.					
Oats.................bush.	\$0 57 to \$0 60	\$0 63 to \$0 68	\$0 53 to \$0 57	\$0 55 to \$0 58	\$0 64 to \$0 70
Hay, prime..........ton.	29 00 to 30 00	27 00 to 28 00	28 00 to 30 00	35 00..........	35 00..........
choice..............	32 00 to 34 00	28 00 to 30 00	31 00 to 32 50	37 00 to 40 00	35 00..........
Pork, mess..........bbl.	14 00 to 15 00	15 50 to 15 $87\frac{1}{2}$	14 50 to 15 00	13 25..........	13 50 to 13 75
Beef, mess, Texas........	10 00 to 16 00	.........12 00	11 00 to 12 00	11 00 to 12 00	11 00 to 12 00
western............	....	....	16 00 to 17 75	15 00 to 16 00	16 50..........
northern............	....	....	16 00 to 17 50	16 50 to 17 00	16 50 to 17 00
Lard...................lb.	9 to $10\frac{1}{2}$	$9\frac{1}{2}$ to $10\frac{1}{2}$	$9\frac{1}{4}$ to $10\frac{1}{4}$	$9\frac{1}{4}$ to $10\frac{1}{8}$	$8\frac{3}{4}$ to 11
Butter, choice western...	25 to 28	22 to 25	22 to 25	30..........	28 to 30
Goshen............	33 to 35	32 to 34	34..........	40..........	40..........
Cheese, choice factory...	15..........	17..........	17..........	19..........	....
Western Reserve.	13 to $13\frac{1}{2}$	14 to 15	16..........	18..........	10 to 17
New York cream.	16 to 17	13 to $13\frac{1}{2}$	18..........	20..........	22..........
Cotton, ordinary to good ordinary.......	.........19 1-6	$19\frac{3}{4}$ to $20\frac{1}{8}$	19 to $20\frac{3}{4}$	$19\frac{1}{2}$ to $21\frac{3}{4}$	$19\frac{1}{4}$ to $21\frac{1}{4}$
low middling to good middling..	$19\frac{3}{8}$ to $20\frac{5}{8}$	$21\frac{3}{8}$ to $22\frac{3}{4}$	21 to $22\frac{5}{8}$	22 to $23\frac{1}{4}$	$22\frac{1}{3}$ to $23\frac{3}{4}$
Tobacco, lugs............	7 to 8	$7\frac{1}{2}$ to 8	8 to $8\frac{3}{4}$	8 to 9	8 to 9
low leaf.........	8 to $8\frac{1}{2}$	$8\frac{1}{2}$ to 9	9 to $9\frac{1}{2}$	9 to $9\frac{1}{2}$	9 to 10
medium leaf....	9 to $9\frac{1}{2}$	$9\frac{1}{2}$ to 10	$9\frac{1}{2}$ to $10\frac{1}{2}$	$9\frac{3}{4}$ to 11	10 to $11\frac{1}{2}$
Wool, lake...............	40 to 42	40 to 42	42 to 43	42 to 43	50..........
Louisiana clean...	37 to 38	41..........	41..........	41..........	40 to 44
Texas............	....	....	....	30 to 31	40 to 45
SAN FRANCISCO.					
Flour, superfine.....bbl.	6 00..........	5 50 to 5 75	5 50..........	4 75 to 5 00	4 50 to 5 00
extra superfine....	6 25 to 6 50	5 $87\frac{1}{2}$ to 6 00	5 75 to 6 00	5 25 to 5 50	5 50 to 5 75
higher grades.....	7 00..........	6 25 to 6 50	6 25 to 6 50	5 75 to 6 25	6 00 to 6 25
Wheat, California.cental.	2 25 to 2 35	2 05 to 2 25	2 05 to 2 25	1 75 to 1 95	1 85 to 2 05
Oregon...........	2 25 to 2 35	2 10 to 2 25	2 15 to 2 25	1 85 to 1 95	1 85 to 2 05
Barley....................	1 75 to 1 90	1 50 to 1 60	1 40 to 1 55	1 30 to 1 50	1 35 to 1 55
Oats......................	1 75 to 1 $87\frac{1}{2}$	1 60 to 1 80	1 55 to 1 75	1 50 to 1 70	1 55 to 1 70
Corn, white..............	2 10 to 2 15	1 50..........	2 10 to 2 15	1 50..........	1 75 to 1 85
yellow............	2 10 to 2 15	1 50..........	1 75 to 1 80	1 45 to 1 50	1 50 to 1 55
Hay, State...........ton.	18 00 to 23 00	17 00 to 22 00	14 50 to 23 50	15 00 to 22 50	10 00 to 20 00
Pork, mess..........bbl.	19 00 to 22 00	18 50..........	15 00 to 17 50	17 00 to 18 00	17 00 to 18 00
prime mess........	17 50 to 18 50	17 00 to 18 00	15 00 to 16 00	16 00 to 17 50	16 00 to 17 50
Beef, mess...............	13 00 to 14 00	13 00 to 14 00	13 50 to 15 00	12 00 to 14 00	12 00 to 14 00
family mess.hf. bbl	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00	10 00 to 11 00
Lard..................lb.	$11\frac{1}{2}$ to 13	$11\frac{1}{2}$ to 13	$11\frac{1}{2}$ to 13	$11\frac{1}{2}$ to 13	$11\frac{1}{2}$ to $13\frac{3}{4}$
Butter, overland.........	20 to 30	20 to 25	20 to 25	20 to $22\frac{1}{2}$	15 to 20
California.......	35 to 40	25 to $32\frac{1}{2}$	25 to $32\frac{1}{2}$	20 to 25	20 to 25
Oregon..........	20 to 25	15 to 20	15 to 20	15..........	10 to 15
Cheese....................	15 to 17	15 to 17	18 to 20	16 to 22	13 to 17
Wool, native..............	18 to 20	20	30..........	35 to 40	35 to 40
California.........	$22\frac{1}{2}$ to 25	$22\frac{1}{2}$ to 30	35 to 45	45 to 55	45 to 55
Oregon............	30	28 to 30	40 to 45	40 to 50	40 to 50

PRODUCTS FOR 1872.

the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$0 51 to $0 56	$0 40 to $0 46	$0 42 to $0 46	$0 32 to $0 40	$0 37 to $0 43	$0 37½ to $0 40	$0 43 to $0 45
28 00 to 32 00	25 00 to 28 00	24 00 to 25 00	27 00	24 50 to 26 50	25 00 to 27 50	25 00 to 26 00
34 00 to 36 00	28 00 to 30 00	26 00 to 30 00	28 00 to 30 00	28 00 to 29 00	28 00 to 28 50	30 00 to 31 00
13 00 to 13 25	12 50 to 13 00	13 50	14 50 to 14 75	15 50 to 15 75	17 50 to 19 50	13 50 to 14 00
11 00 to 12 00	11 50 to 12 00	11 00 to 12 50	11 00 to 12 00	11 00 to 12 50	11 00 to 12 50	11 00 to 12 50
15 50 to 16 00	15 50 to 16 00	14 00 to 15 00	14 00 to 15 00	14 00 to 15 00	16 00	16 00 to 17 50
16 50 to 17 00	.... 17 00	15 50 to 16 00	15 50 to 17 50	16 00	....	....
8¾ to 11	8¾ to 10¾	9¼ to 11	10 to 12½	9¾ to 12	9 to 11	....
25 to 28	16 to 18	17 to 20	18	22 to 24	22 to 23	25 ....
38 to 40	28 to 30	30	30	31 to 32	33 to 34	33 to 34
12 to 14	12 to 13	14 to 15	12 to 13	18	15 to 15½	14 ....
....	12 to 12½	....	....	....	....	....
....	17	16	16	18 to 19	17 to 18	17 ....
19½ to 22½	19¾ to 22⅓	19	...........19⅜	...........18⅛	16 to 18¼	16⅓ to 17⅝
23⅜ to 24⅝	............24¼	19¼	20¾ to 21⅓	18⅝ to 19½	18⅜ to 19½	18 to 19⅞
8 to 9	8 to 9	8½ to 9½	8½ to 9½	8½ to 9½	8½ to 9½	8 to 9
9 to 10	9½ to 10	9½ to 10½	9½ to 10½	9½ to 10½	9½ to 10½	9 to 9¾
10 to 11½	10½ to 11½	10½ to 11½	10½ to 11½	10½ to 11½	10½ to 11½	9¾ to 10¾
48 to 50	47 to 48	43 to 45	40 to 44	40 to 44	40	46 ....
....	40 to 43	35 to 40	37 to 40	37 to 40	35 to 37	40 to 42
40 to 43	40 to 43	35 to 40	35 to 40	35 to 40	....	....
4 75 to 5 25	4 50 to 4 75	4 00 to 4 50	4 00 to 4 25	4 00 to 4 25	3 75 to 4 10	3 90 to 4 25
5 50 to 6 25	5 00 to 5 25	4 75 to 5 00	4 50..........	4 50 to 4 75	4 25 to 4 50	4 50 to 4 75
6 25 to 6 50	5 50 to 6 25	5 25 to 6 00	4 75 to 5 75	5 00 to 5 50	5 00 to 5 50	5 00 to 5 50
1 85 to 2 10	1 60 to 1 85	1 50 to 1 65	1 45 to 1 65	1 45 to 1 65	1 45 to 1 62½	1 60 to 1 80
1 85 to 2 10	1 75 to 1 85	1 60 to 1 65	1 55 to 1 60	1 60 to 1 65	1 50 to 1 62½	1 60 to 1 80
1 37½ to 1 55	1 00 to 1 60	1 10 to 1 55	1 05 to 2 00	1 10 to 1 50	1 15 to 1 30	1 30 to 1 50
1 65 to 1 80	1 50 to 1 70	1 85 to 2 00	1 55 to 1 75	1 55 to 1 75	1 50 to 1 65	2 00 to 2 35
1 55..........	1 50..........	1 60 to 1 65	1 70 to 1 75	1 70 to 1 75	1 35 to 1 45	1 30 to 1 35
1 45 to 1 50	1 45..........	1 55 to 1 60	1 60 to 1 65	1 60 to 1 62½	1 30 to 1 35	1 25 to 1 30
16 00 to 22 00	9 00 to 15 00	9 00 to 15 00	9 00 to 16 00	10 00 to 16 00	10 00 to 17 00	14 00 to 22 00
17 00 to 17 50	16 00 to 16 50	17 00 to 18 00	17 00 to 18 00	17 00 to 18 00	17 00 to 18 00	19 00 to 20 00
16 00..........	15 00 to 16 00	16 00 to 17 00	17 50 to 18 00	17 50 to 18 00	17 50 to 18 00	19 00 to 20 00
12 00 to 14 00	12 00 to 14 00	12 00 to 14 00	12 00 to 13 00	12 00 to 13 00	12 00 to 13 50	11 00 to 12 50
10 00 to 11 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00
10 to 13	10 to 12½	10 to 11½	10½ to 11½	10½ to 11½	10¾ to 11½	10 to 11½
15 to 20	15 to 20	18 to 20	22½ to 27½	20 to 25	16 to 27½	15 to 32½
25 to 28	22½ to 25	25 to 30	30 to 42½	30 to 45	40 to 65	40 to 60
10 to 15	10 to 15	15 to 18	20..........	20..........	18 to 20	18 to 20
14 to 22½	12 to 16	10 to 15	11 to 15	11 to 15	11 to 15	12 to 16
35 to 40	20 to 30	20 to 30	12 to 25	12 to 20	10 to 20	12 to 20
45 to 50	35 to 40	35 to 37½	30 to 37½	20 to 25	20 to 25	25 to 30
40 to 50	35 to 40	35 to 40	35 to 38	30 to 35	30 to 35	25 to 30

LIVE-STOCK MARKET.

NEW YORK.

The live-stock trade of New York, during 1872, was not in any way more satisfactory than during 1871. Considerable losses were entailed upon contractors, who seem to have calculated with great confidence upon an enhancement of prices, which, on the contrary, materially declined. The average price of cattle during the year was 11⅝ cents per pound against 12 cents in 1871, and 14½ cents in war times. The averages have been remarkably uniform during the year, yet exhibiting a wide range; poor Texans, for example, selling at one-half the rates of fine "natives." The hog-trade was especially discouraging to dealers, prices ruling low.

The arrivals of farm-animals during the five years just closed were as follows:

	1868.	1869.	1870.	1871.	1872.
Beeves	293, 101	325, 761	356, 026	380, 934	425, 275
Cows	5, 382	4, 836	5, 050	4, 646	5, 089
Calves	82, 935	93, 984	116, 457	121, 937	115, 130
Sheep	1, 400, 623	1, 479, 563	1, 463, 878	1, 331, 975	1, 179, 518
Hogs	976, 511	901, 308	889, 625	1, 334, 492	1, 922, 727
Total	2, 758, 552	2, 805, 452	2, 831, 036	3, 273, 984	3, 647, 739

A considerable increase is noted in the number of beeves and cows, and a very large increase in hogs, while calves and sheep exhibit a marked decline. The weekly receipts of farm-animals average as follows: Beeves, 7,187; cows, 88; calves, 3,301; sheep, 25,132; hogs, 25,179; total, 70,149.

Of the above aggregates of cattle Illinois furnished 241,864; Texas, 59,926; Kentucky, 35,996; Ohio, 34,550; Missouri, 19,083; Indiana, 12,387; New York, 12,010; Virginia, 4,752; Iowa, 1,302; Michigan, 1,270; Canada, 786; Pennsylvania, 561; New Jersey, 210; Tennessee, 192; Kansas, 144; Colorado, 66; Connecticut, 46; Delaware, 30. Texas, which last year was fourth on the list, now ranks second. Undoubtedly the very large aggregate of Illinois partly represents contributions from neighboring States marketing their cattle at Chicago. The heavy decline in sheep is due to the revival of the wool business. A lack of good mutton-sheep is especially noted in the New York market, where the best animals for the table were obtained from Canada. The prices of sheep were lower than in 1871.

The average prices per pound of live stock at the close of the first week of each month of 1872 were as follows:

Months.	Beeves.				Sheep.	Hogs.
	Average.	Fancy.	Good to prime.	Common to fair.		
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	11¼	13	11½ to 12½	9 to 11	7 to 7¾	5 to 5¼
February	11½	13	11½ to 12½	9½ to 11	6¼ to 8⅜	5½ to 5⅝
March	11½	13¾	11½ to 12½	9¼ to 10½	7¾ to 9½	5⅛ to 5⅜
April	11½	13	12 to 12½	10 to 11½	7 to 10	4¾ to 5
May	12¼	13½	12 to 13	10¾ to 11¾	6½ to 7¾	4¼ to 4½
June	12½	13½	12 to 13	10 to 11½	6¼ to 7½	4¼ to 4½
July	11½	12	11 to 13½	7½ to 10	5 to 7	4⅜ to 4⅝
August	12	13½	11 to 12½	9 to 10	5 to 7	4⅜ to 4⅝
September	11¾	13½	12 to 13	7½ to 11	5 to 7	5¼ to 5½
October	11½	14¼	12½ to 13½	7 to 10½	5 to 7	5¼ to 5½
November	11	14	12 to 13	7 to 10	4¾ to 6¾	5⅜ to 5⅝
December	11	15	12 to 13½	6½ to 11	4 to 6½	4⅝ to 4⅞

Imports of foreign wool into New York during 1871 and 1872.

	1871.			1872.		
	Bales.	Pounds.	Entered value.	Bales.	Pounds.	Entered value.
EUROPE.						
England	36,984	15,671,681	$3,757,615	46,532	19,199,179	$5,172,838
Belgium	221	162,229	20,401	462	421,226	89,130
France	4,156	1,263,329	175,762	2,174	617,414	156,961
Germany	210	69,190	10,815	386	206,597	53,748
Turkey	53	19,628	1,532	2,326	753,045	158,035
Greece	......	......	......	1,225	454,341	55,665
Spain	......	......	......	58	12,658	2,406
Russia	10,795	4,218,164	513,600	13,068	5,029,567	1,283,138
Austria	2,631	882,025	118,834	4,112	1,028,871	194,390
Italy	677	217,573	29,090	60	30,737	4,735
Scotland	90	34,369	4,746	......	......	......
Portugal	7	3,200	347	15	4,307	620
ASIA.						
Hindostan	......	......	......	51	33,247	3,624
British East Indies	628	212,386	36,414	895	376,246	48,878
China	......	......	......	618	232,982	55,839
AFRICA	9,313	4,064,167	568,551	15,589	6,760,051	1,513,914
NORTH AMERICA.						
Mexico	......	......	......	27	4,916	767
SOUTH AMERICA.						
Argentine Republic	8,566	7,228,395	843,034	6,728	4,082,088	684,254
Brazil	2,196	1,430,383	228,138	1,853	1,231,954	230,878
New Granada	......	......	......	534	131,645	29,618
West Indies	16	208	91	50	14,967	1,279
Cisplatine Republic	3,741	3,448,257	458,732	5,581	5,221,126	956,531
Chili	2,567	1,251,741	118,319	4,598	2,140,920	323,467
Peru	......	......	......	518	237,497	20,717
Venezuela	......	......	......	618	232,982	55,839
AUSTRALASIA.						
Australia	......	......	......	5,234	2,270,810	533,412
New Zealand	......	......	......	12	4,753	1,067
Grand total	82,902	40,180,925	6,886,267	112,953	50,515,278	11,587,201

During 1872, 8,984 bales of sheep-skins were imported into the port of New York, which were valued at $1,366,885. Of this aggregate 2,056 bales, valued at $330,316, were imported during the last six months of the year. The imports of 1871 were 3,481 bales, valued at $277,618; of this amount 923 bales, worth $114,445, were received during the last six months of the year.

Receipts of cattle and hog products during the last three years.

	1870.	1871.	1872.
Pork .... packages	123,296	175,896	145,071
Beef .... barrels	127,298	164,603	58,585
Cut meats .... packages	98,262	193,820	331,288
Butter .... do	530,813	709,473	680,688
Cheese .... do	1,544,924	1,467,633	1,714,210
Lard .... tierces and barrels	93,523	286,521	355,092
Lard .... kegs	24,989	22,207	28,021

Exports of cattle and hog products during the last three years.

	1870.	1871.	1872.
Pork .... barrels..	88, 050	165, 085	158, 194
Beef .... do....	24, 496	45, 277	36, 054
Beef .... tierces..	57, 885	89, 402	49, 085
Cut meats .... pounds..	30, 926, 699	96, 455, 254	209, 356, 144
Butter .... do....	1, 399, 354	7, 500, 347	4, 814, 497
Cheese .... do....	61, 710, 435	70, 024, 588	67, 109, 248
Lard .... tierces..	32, 074, 063	125, 524, 276	173, 736, 353
Tallow .... do....	18, 245, 508	42, 912, 410	55, 866, 902

BOSTON.

The receipts of farm-animals for ten years just closed were as follows:

Year.	Cattle.	Sheep.	Veals.	Fat hogs.	Pigs.
1863	110, 815	250, 597	16, 005	68, 890	22, 950
1864	118, 836	302, 350	16, 570	53, 372	15, 759
1865	117, 866	341, 381	17, 798	70, 329	29, 208
1866	118, 185	431, 218	10, 205	84, 609	26, 210
1867	107, 866	421, 940	12, 387	96, 491	10, 272
1868	110, 010	432, 736	13, 700	127, 544	10, 443
1869	129, 353	440, 404	13, 000	145, 200	22, 818
1870	124, 592	450, 997	16, 000	168, 902	20, 528
1871	129, 147	467, 065	13, 230	338, 027	13, 280
1872	157, 366	412, 217	17, 852	592, 726	9, 298
Total	1, 224, 036	3, 950, 905	146, 747	1, 746, 090	180, 766

Cattle products.—The receipts and exports of mess-beef, butter, and cheese during 1871 and 1872 were as follows:

	1871.	1872.
Receipts:		
Beef, mess .... barrels..	27, 441	24, 951
Butter .... packages..	442, 318	461, 917
Cheese .... casks..	554	283
Cheese .... boxes..	202, 487	187, 484
Cheese .... tons..	131	129
Exports:		
Beef, foreign .... barrels..	8, 114	7, 932
Beef, coastwise .... barrels..	1, 354	904
Cheese, foreign .... boxes..	8, 719	4, 726
Cheese, foreign .... casks..	68	....
Cheese, coastwise .... boxes..	1, 639	1, 922
Butter .... packages..	8, 594	6, 457

The range of prices per barrel of western beef—mess and extra—during the past ten years was as follows: 1863, $11 to $16; 1864, $14 to $20; 1865, $10 to $26; 1866, $16 to $24.50; 1867, $15 to $27; 1868, $15.50 to $25; 1869, $10 to $18; 1870, $12 to $19; 1871, $10 to $18; 1872, $10 to $14.

Prices of butter and cheese during the past ten years ranged as follows:

Year.	Butter, per pound.		Cheese, per pound, common to prime.
	Good and choice.	Common.	
1863	$0 16 to $0 32	$0 12 to $0 25	$0 06 to $0 16
1864	29 to 55	24 to 50	11 to 24
1865	28 to 55	15 to 50	6 to 23
1866	34 to 60	17 to 45	6 to 23
1867	23 to 45	10 to 35	5 to 21
1868	35 to 55	25 to 40	4 to 20
1869	35 to 50	20 to 40	6 to 24
1870	27 to 45	20 to 35	6 to 18¼
1871	22 to 43	13 to 25	6 to 16
1872	20 to 37	12 to 25	6 to 20

Hog products.—Receipts and exports of hog products during 1871 and 1872:

		1871.	1872.
Receipts:			
Pork	barrels..	39,754	36,731
Bacon	boxes..		40,332
Hams	casks..	3,988	10,300
Hams	barrels..	9,961	5,532
Lard	tierces..	37,081	39,644
Lard	kegs..	1,665	754
Exports:			
Bacon, foreign	boxes..	63,213	107,408
Pork, foreign	barrels..		27,063
Pork, coastwise	barrels..	4,695	6,005
Lard, foreign	tierces..	21,335	28,515
Lard, coastwise	tierces..	690	508
Lard, foreign	kegs and pails..	14,758	13,377
Lard, coastwise	kegs and pails..	832	812

The range of prices of prime and mess pork and of lard during the past ten years was as follows:

Year.	Prime pork, per barrel.	Mess-pork, per barrel.	Lard, per pound.
1863	\$11 50 to \$16 50	\$13 00 to \$22 60	10 to 13¾
1864	16 00 to 40 00	21 00 to 45 00	13¼ to 25½
1865	20 00 to 39 50	24 00 to 44 00	18 to 30
1866	18 00 to 31 00	22 00 to 35 00	13 to 23
1867	17 00 to 21 00	21 00 to 25 50	13 to 15
1868	18 50 to 26 00	23 00 to 31 50	13¼ to 21
1869	24 00 to 28 00	31 00 to 34 50	18⅛ to 21½
1870	16 00 to 26 00	20 00 to 23 00	12½ to 19
1871	11 00 to 19 00	13 50 to 23 50	9½ to 14
1872	11 25 to 13 00	13 75 to 17 00	8¼ to 10

Sheep products.—The range of prices of wool during the past year was as follows: picklock and XX Ohio and Pennsylvania, 57 to 85 cents per pound; medium and X Ohio and Pennsylvania, 56 to 85; Michigan, 52 to 82; western, 50 to 82. The highest and lowest prices for the last ten years for common western up to choice and picklock, Pennsylvania and Ohio, were as follows: 1863, 60c. to \$1.05; 1864, 62c. to \$1.25; 1865, 50c. to \$1.10; 1866, 40c. to 89c.; 1867, 32½c. to 80c.; 1868, 35c. to 70c.; 1869, 36c. to 70c.; 1870, 36c. to 65c.; 1871, 40c. to 75c.; 1872, 50c. to 85c.

The receipts of domestic wool during the same period were as follows: 1863, 112,631 bales; 1864, 157,262; 1865, 180,750; 1866, 177,346; 1867, 196,431; 1868, 236,970; 1869, 216,320; 1870, 185,015; 1871, 204,697; 1872, 157,741. The imports of foreign wool during the same period were as follows: 1863, 22,644 bales; 1864, 35,431 bales and 5,746 quintals; 1865, 21,101 bales; 1866, 34,218 bales; 1867, 23,994 bales; 1868, 17,418 bales; 1869, 27,399 bales and 7,176 quintals; 1870, 26,193 bales; 1871, 56,772; 1872, 88,157. The stocks of domestic wool left at the close of each of the last eight years were as follows: 1865, 6,000,000 pounds; 1866, 6,500,000; 1867, 7,000,000; 1868, 11,117,000; 1869, 8,706,000; 1870, 6,977,500; 1871, 7,165,000; 1872, 3,662,000. The stocks of foreign wool left at the close of each of the last seven years were as follows: 1866, 5,435,000 pounds; 1867, 5,155,000; 1868, 2,840,000; 1869, 4,550,000; 1870, 2,052,000; 1871, 4,306,000; 1872, 9,910,000.

During the first four months of 1872 the importation of foreign wool into Boston amounted to 25,000,000 pounds, and came, almost exclusively, from New Zealand, Australia, Mestiza, and the Cape. During

the same four months large arrivals of foreign wool were reported at New York. During the first four months of 1873 it was anticipated that the imports would be lighter than during the same period of 1872, the prices having risen in Australia, New Zealand, South America, and the Cape districts. In Great Britain the stock of wool was 25 per cent. less than at the close of 1871, and manufacturers were fully and profitably employed. Domestic wool arrived very freely during the later months of 1872, but the bulk of the clip had passed into the hands of speculators, dealers, and manufacturers at the close of the year. Most of the foreign wools then on hand were heavy Cape and Mestiza, subject to great shrinkage, of which about 3,000,000 pounds were carpet-wools, leaving but a limited available stock of clothing-wool. Some doubts were expressed as to the possibility of securing the average arrival of 1872, inasmuch as it would require not less than 4,000,000 pounds per week from January 1 to June 1, on the ground that the high price of the raw material would restrict its fabrication into cloth, and that, consequently, the demand would be lessened and prices would fall below the point necessary to attract a full supply. The continued steady demand for woolen goods, however, seemed to have disposed of these doubts, and manufacturers, at the close of the year, generally expected to run their mills to their full capacity. The prices of domestic wool for the current year will depend upon the supply of foreign, which was 31,000 bales greater in 1872 than in 1871.

PHILADELPHIA.

The monthly receipts of farm-animals during 1872 were as follows:

	Beeves.	Cows.	Hogs.	Sheep.
January	9,950	950	17,072	72 000
February	9,750	900	16,850	62,000
March	8,850	950	16,300	60,400
April	9,800	1,150	16,461	64,400
May	8,800	1,050	14,231	67,400
June	10,500	1,170	15,181	58,300
July	11,600	1,160	18,343	69,000
August	12,300	950	14,200	51,300
September	16,000	922	20,334	77,000
October	14,800	850	23,928	61,400
November	12,300	1,250	19,640	58,700
December	10,200	1,000	18,836	48,000
Total	134,850	12,302	210,276	749,500
Total 1871	125,333	11,150	199,610	796,200
Total 1870	117,903	8,835	189,500	682,900
Total 1869	99,486	8,805	176,200	536,500
Total 1868	90,400	9,314	191,900	417,800
Total 1867	90,150	11,464	175,500	368,500
Total 1866	100,500	10,830	122,500	512,000
Total 1865	96,450	6,540	136,300	306,000
Total 1864	99,850	7,920	140,400	295,000
Total 1863	103,150	6,905	167,370	275,100
Total 1862	87,520	4,650	206,000	229,300
Total 1861	82,365	4,217	199,179	260,020
Total 1860	99,845	10,673	127,964	324,564
Total 1859	87,555	11,153	151,226	272,160
Total 1858	81,990	17,125	165,600	277,000
Total 1857	64,100	14,700	95,700	342,000
Total 1856	61,978	12,990	103,850	240,700
Total 1855	55,250	11,530	65,300	135,500
Total 1854	73,303	15,530	70,000	61,000
Total 1853	71,900	16,300	53,300	72,300
Total 1852	71,200	14,420	49,200	80,200
Total 1851	69,100	15,400	46,700	83,000
Total 1850	68,780	15,120	46,900	82,500

BALTIMORE.

Beef-cattle.—The receipts of beef-cattle at Baltimore, during the past six years, were as follows: 1867, 55,713; 1868, 75,891; 1869, 91,000; 1870, 89,021; 1871, 88,386; 1872, 92,292. Of the aggregate received during the year just closed the "Baltimore butchers" took 43,000 head, worth, in round numbers, $2,500,000. Of the residue 35,000 head were taken by speculators for eastern markets. The remainder were taken by butchers and farmers of the city and its environs for home consumption. The average price of cattle during 1872 was $5.20 per cental against $5.54 in 1871. The prices of cattle at the beginning of each month of 1872 were as follows:

Months.	Common to fair.	Good and prime.	Average.
January	$4 00 to $5 50	$6 00 to $7 25	$5 25
February	3 50 to 5 50	6 00 to 7 00	5 12½
March	4 50 to 5 50	6 25 to 7 25	5 50
April	4 00 to 5 25	6 00 to 7 37½	5 37½
May	4 87½ to 5 50	5 62½ to 6 75	6 12½
June	5 00 to 5 75	7 00 to 7 75	6 50
July	3 75 to 4 75	5 62½ to 6 87½	5 00
August	4 00 to 5 00	5 75 to 7 00	5 12½
September	4 00 to 5 25	6 00 to 6 75	4 50
October	3 25 to 4 50	6 00 to 7 00	4 50
November	3 50 to 4 50	5 75 to 6 87½	4 37½
December	4 00 to 4 75	6 00 to 7 25	4 50

Hogs.—The receipts of live hogs during the past three years were as follows: 1870, about 300,000; 1871, 307,436; 1872, 400,874. These were mostly, if not entirely, slaughtered by city butchers, and represent, at an average of $10 per head, an aggregate value of $4,008,740. The product not required for home consumption is shipped to other markets.

The prices of live hogs at the 15th of each month of 1872 were as follows: January, $6 to $7.50; February, $6.50 to $7.50; March, $6.50 to $7.25; April, $6 to $6.75; May, $5.50 to $6.50; June, $5.75 to $6.25; July, $6 to $6.25; August, $6.50 to $7.25; September, $7.25 to 7.50; October, $6.50 to $7; November, $5.75 to $6.50; December, $5 to $5.50.

The receipts of hog products by rail at Baltimore, during 1872, are estimated at 100,000,000 pounds, or about 20,000,000 pounds more than during the previous year. The prices of mess-pork on the 15th of each month for the past three years were as follows:

Months.	1870.	1871.	1872.
	Per barrel.	*Per barrel.*	*Per barrel.*
January	$29 25 to $30 00	$20 25 to $20 50	$14 50 to ......
February	27 00 to 27 50	23 25 to 23 50	14 00 to $14 50
March	26 50 to	21 50 to 21 75	13 50 to ......
April	28 50 to	20 75 to 21 00	13 50 to ......
May	29 75 to	18 00 to 18 25	14 00 to ......
June	31 00 to	16 00 to 16 50	13 50 to ......
July	30 75 to 31 00	15 50 to 16 00	14 00 to ......
August	30 75 to 31 00	14 50 to 15 00	14 50 to ......
September	28 00 to 28 50	13 75 to 14 00	14 75 to ......
October	27 00 to 27 50	14 50 to 14 75	15 50 to ......
November	25 00 to 26 00	14 25 to 14 50	17 00 to ......
December	20 00 to	14 50 to 15 00	14 50 to ......

The average prices of provisions on the 1st day of each month of 1872 were as follows:

Months.	Mess-pork, per barrel.	Lard, per pound, (tierces.)	Bulk shoulders, per pound.	Bulk sides, per pound.	Bacon, sides, per pound.	Bacon, shoulders, per pound.	Hams, per pound.
January	$15 00	$0 09¼	$0 05¼	$0 06¼	$0 08	$0 7½	$0 15
February	14 50	9½	5½	6½	8½	7	15
March	14 00	9¼	5	6½	7¼	6¾	14
April	13 25	9	4¾	6¼	7½	5½	13
May	14 00	9½	5	6⅝	7¾	6	13
June	13 75	9	5	6½	7¾	6	14
July	13 50	9	5¼	6¾	7¾	6	15
August	14 00	8¾	6½	8	8⅝	7¼	17
September	15 00	9	7½	9½	10¾	8½	17½
October	15 50	8½	7¼	10	11½	8½	22
November	16 00	8¼	6½	9¼	10¾	7	17½
December	15 00	8¼	4¾	6¼	9½	6	15

During 1872 the butchers of Baltimore slaughtered about 400,000 hogs, about 100,000 more than in 1871. The receipts of hog products by rail amounted to about 100,000,000 pounds against 80,000,000 in 1871. The quantities distributed for domestic and foreign consumption during 1871 and 1872 were estimated as follows:

		1871.	1872.
Bacon and bulk meats	hhds.	60, 000	70, 000
Hams	casks.	18, 000	20, 000
Lard	tierces.	25, 000	55, 000
Pork	barrels.	24, 000	30, 000

CINCINNATI.

Cattle.—The annual statistics of Cincinnati are collected by the Chamber of Commerce at the close of each commercial year, which ends August 31. The receipts and shipments of cattle during the last fifteen years were as follows:

Year.	Receipts.	Shipments.	Year.	Receipts.	Shipments.
1858	29, 566	17, 115	1866	79, 503	31, 300
1859	43, 100	23, 615	1867	91, 406	43, 079
1860	43, 182	20, 593	1868	87, 459	43, 315
1861	40, 585	19, 357	1869	107, 813	40, 185
1862	37, 004	23, 467	1870	107, 167	54, 681
1863	31, 915	16, 739	1871	125, 771	53, 278
1864	39, 152	14, 903	1872	169, 855	76, 866
1865	54, 424	19, 070			

The receipts and shipments of the last commercial year were larger than those of any previous year. The quality was but little varied from the previous years. Cattle for shipment generally came from Kentucky, and were scarcely equal to the arrivals of the previous year. Of the entire receipts about 20 per cent. were Texas cattle. The average prices per cental gross of prime beef-cattle, on Tuesday of the first week in each month during the last five commercial years, were as follows:

Months.	1871–'72.	1870–'71.	1869–'70.	1868–'69.	1867–'68.
September	$3 50	$6 25	$5 75	$6 00	$7 25
October	4 00	5 25	5 25	5 00	7 00
November	3 50	4 75	4 50	5 00	6 50
December	3 75	4 75	4 75	5 50	6 50
January	5 25	5 25	5 50	5 00	6 50
February	5 00	5 25	6 00	5 50	7 00
March	4 75	5 35	5 60	6 00	7 75
April	5 50	5 75	6 50	6 00	8 50
May	5 60	5 50	7 00	6 50	8 50
June	5 50	4 50	7 00	6 00	8 25
July	5 00	4 25	6 50	6 00	7 00
August	5 25	3 50	6 25	5 50	6 75

The annual average prices of prime beef-cattle for the last fifteen commercial years were as follows: 1857–'58, $3.78; 1858–'59, $4.88; 1859–'60, $3.90; 1860–'61, $3.30; 1861–'62, $3.24; 1862–'63, $3.96; 1863–'64, $5.74; 1864–'65, $7.45; 1865–'66, $7.55; 1866–'67, $7.27½; 1867–'68, $7.27; 1868–'69, $5.62½; 1869–'70, $5.85; 1870–'71, $5.05½; 1871–'72, $4.73½.

The prices of all grades of cattle at the close of the last two commercial years were as follows:

	1870–'71.	1871–'72.
Extra shipping, per cental gross	$4 75 to $5 00	$5 50 to $6 00
Prime, per cental gross	3 50 to 4 25	4 75 to 5 25
Medium, per cental gross	3 00 to 3 25	3 00 to 3 50
Common, per cental gross	2 25 to 2 50	2 50 to 3 00

NOTE.—Nearly all the cattle quoted as "common" were Texans.

CATTLE PRODUCTS.—*Butter:* Among the noticeable points of the butter-trade is the marked improvement of the Central Ohio butter, which now begins to rival the famed Western Reserve, both in quality and in preparation for market. The extreme range of prices for Central Ohio butter during the last commercial year was from 14 to 27 cents per pound; the average was 20.04, a lower average than during any year since 1862–'63.

The prices per pound of prime Central Ohio on the first Tuesday of each month of the past four commercial years were as follows:

Months.	1868–'69.	1869–'70.	1870–'71.	1871–'72.
September	$0 34	$0 32	$0 29	$0 18
October	36	31	32	19
November	34	32	32	17
December	35	33	27	21¼
January	38	31	27	20
February	30	28	26	21
March	37	30	26	22
April	40	33	27	27
May	33	27	22	25
June	23	20	22	17
July	24	20	16	14
August	26	27	16	18

The annual average prices per pound of prime Central Ohio, for the past fifteen commercial years, were as follows: 1857–'58, 15 cents; 1858–'59, 19 cents; 1859–'60, 14⅛ cents; 1860–'61, 13⅙ cents; 1861–'62, 12½ cents; 1862–'63, 11½ cents; 1863–'64, 29 cents; 1864–'65, 35 cents; 1865–'66, 36⅓ cents; 1866–'67, 26½ cents; 1867–'68, 36½ cents; 1868–'69, 32⅞ cents; 1869–'70, 28⅓ cents; 1870–'71, 24⅝ cents; 1871–'72, 20.04 cents.

The prices per pound of all kinds of butter at the close of each of the last three commercial years were as follows:

	1870.	1871.	1872.
Western reserve	$0 30 to $0 32	$0 18 to $0 20	$0 20 to $0 22
Choice Central Ohio	28 to 30	16 to 18	17 to 19
Medium Central Ohio	22 to 25	12 to 14	10 to 12
Common Central Ohio	14 to 18	8 to 10	8 to 9
Grease			6¼ to 7¼

Receipts and shipments of butter for twenty-six commercial years.

Years.	Receipts.		Shipments.	
	Barrels.	Kegs and firkins.	Barrels.	Kegs and firkins.
1847	6,345	7,090	1,348	31,194
1848	6,625	6,405	2,937	28,315
1849	7,721	7,999	1,272	24,398
1850	3,674	7,487	1,964	24,393
1851	8,259	11,043	3,258	36,185
1852	10,203	13,720	3,006	31,395
1853	16,484	11,331	3,833	42,316
1854	16,842	11,692	3,603	41,595
1855	10,185	7,132	1,300	24,196
1856	11,361	12,422	2,391	28,128
1857	11,352	10,818	2,569	21,913
1858	14,525	17,945	2,949	29,007
1859	10,034	23,055	1,607	27,286
1860	15,209	24,468	4,056	48,268
1861	12,395	21,860	2,385	32,046
1862	5,916	14,090	248	9,262
1863	4,408	28,364	977	15,481
1864	11,126	48,754	1,676	18,428
1865	5,327	55,887	2,176	23,636
1866	4,512	67,018	1,758	24,786
1867	2,969	56,414	1,053	22,228
1868	716	56,344	326	12,617
1869	1,009	51,210	443	17,447
1870	1,112	57,010	339	21,753
1871	2,069	68,471	532	19,592
1872	1,721	69,748	789	23,086

Cheese: The cheese-factory system is extending westward and superseding the dairy system. During the past year quantities of Wisconsin and Kentucky factory cheese first made their appearance in market. The receipts and shipments of cheese during the past two commercial years were as follows:

Months.	Receipts.		Shipments.	
	1870–'71.	1871–'72.	1870–'71.	1871–'72.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
September	9,430	23,135	15,617	10,540
October	17,179	32,080	27,494	20,067
November	18,595	24,571	51,182	12,372
December	23,179	26,105	22,677	20,143
January	12,920	11,034	10,984	13,431
February	10,995	3,885	7,044	7,099
March	10,400	4,911	5,923	7,237
April	7,561	4,981	3,544	3,958
May	5,623	12,452	12,402	7,795
June	5,781	15,011	13,879	7,543
July	6,287	11,843	11,111	7,081
August	7,265	16,904	11,865	10,526

The average prices of cheese on the first Tuesday of each month of the past four commercial years were as follows:

Months.	1868–'69.	1869–'70.	1870–'71.	1871–'72.
September	\$0 15	\$0 16	\$0 13½	\$0 9
October	16	17¾	14½	14¼
November	16	19½	15	14½
December	17	19½	15¼	15
January	17½	19	15¼	14¾
February	19	18½	15¼	15½
March	21	18	15½	17½
April	17	17	16	19
May	17	16	15	14
June	15	14	10	12
July	14	11	10	12½
August	13	12	9	12

NOTE.—The prices of 1868–'69 were for Western Reserve, and for the other years factory cheese.

The average annual prices of factory cheese for the last three years were as follows: 1869–'70, 17 cents per pound; 1870–'71, $13\frac{3}{4}$ cents; 1871–'72, $14\frac{1}{2}$ cents. For the previous fourteen years the annual average prices of Western Reserve cheese were as follows: 1855–'56, $9\frac{5}{7}$; 1856–'57, $10\frac{1}{10}$; 1857–'58, $8\frac{1}{9}$; 1858–'59, $8\frac{4}{5}$; 1859–'60, $8\frac{1}{2}$; 1860–'61, $7\frac{4}{5}$; 1861–'62, $6\frac{3}{10}$; 1862–'63, $10\frac{2}{5}$; 1863–'64, 14; 1864–'65, $19\frac{3}{4}$; 1865–'66, $19\frac{1}{3}$; 1866–'67, $11\frac{1}{2}$; 1867–'68, $14\frac{1}{4}$; 1868–'69, $16\frac{1}{2}$ cents.

The aggregate annual receipts and exports of cheese for the last twenty-seven commercial years were as follows:

Years.	Receipts.	Exports.	Years.	Receipts.	Exports.
	Boxes.	*Boxes.*		*Boxes.*	*Boxes.*
1846	90, 050	35, 459	1860	227, 095	172, 753
1847	120, 301	70, 104	1861	156, 583	121, 253
1848	138, 800	59, 374	1862	103, 861	59, 545
1849	143, 265	55, 134	1863	124, 996	71, 839
1850	165, 940	86, 902	1864	114, 167	80, 939
1851	205, 444	121, 755	1865	125, 871	83, 022
1852	241, 753	150, 689	1866	189, 604	141, 618
1853	202, 237	143, 056	1867	200, 971	160, 231
1854	216, 892	139, 728	1868	159, 774	99, 090
1855	183, 379	102, 352	1869	140, 165	105, 039
1856	190, 983	114, 607	1870	198, 963	158, 222
1857	176, 623	112, 692	1871	193, 833	136, 015
1858	199, 578	124, 854	1872	187, 640	128, 260
1859	223, 250	146, 196			

Sheep.—The receipts and shipments of sheep during the last fifteen commercial years were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1858	17, 896	4, 363	1866	73, 229	13, 177
1859	29, 064	6, 025	1867	91, 987	24, 052
1860	25, 069	6, 724	1868	73, 097	19, 809
1861	22, 041	6, 000	1869	117, 548	31, 353
1862	27, 453	7, 433	1870	90, 205	35, 581
1863	25, 900	4, 745	1871	134, 892	51, 109
1864	35, 223	4, 077	1872	187, 522	68, 541
1865	47, 023	5, 815			

The sheep-trade, as shown by the above figures, is rapidly increasing; the quality of the animals offered, however, was generally poor during the past year. The advanced price of wool is alleged as the cause of this depreciation; the better class of animals being reserved by the farmers for the production of fiber, while only inferior grades were sent to the meat-market.

The prices of sheep, of all grades, at the close of the last two commercial years were as follows:

Quality.	1871–'72.	1870–'71.
Choice, per cental gross	$4 50 to $5 00	$4 00 to $4 25
Prime, per cental gross	3 75 to 4 25	3 00 to 3 50
Common, per cental gross	....	2 50 to 2 75
Common, per head	2 00 to 2 50	....
Lambs, per head	2 50 to 3 75	2 50 to 3 75

The average prices per cental gross on Tuesday of the first week in each month for the past four years were as follows:

Months.	1871–'72.	1870–'71.	1869–'70.	1868–'69.
September	$3 25	$3 50	$3 25	$3 00
October	3 25	3 50	3 60	2 75
November	3 50	3 00	3 00	3 00
December	3 50	3 00	3 50	3 25
January	4 50	3 75	3 75	3 25
February	4 50	4 25	4 00	5 00
March	5 00	4 25	5 25	4 75
April	6 00	4 25	5 25	5 50
May	6 25	4 75	5 25	5 25
June	4 50	3 00	4 25	3 60
July	4 25	2 75	3 50	3 50
August	4 50	2 75	3 50	3 50

All quotations, previous to May 21, are for wool-sheep; subsequent to that time for sheared.

SHEEP PRODUCTS.—*Wool.*—The prices per pound of wool on Tuesday of the first week of each month of the last commercial year were as follows:

Months.	Tub-washed.	Unwashed manufacturing.	Pulled.
September	$0 65	$0 40	$0 50
October	65	40	50
November	70	45	52
December	70	45	52
January	70	45	56
February	75	45	62
March	78	48	75
April	78	48	72
May	65	48	65
June	68	45	65
July	67	45	60
August	65	45	55

The prices of prime Ohio fleece on Tuesday of the first week of each month of the past four commercial years were as follows:

Months.	1868–'69.	1869–'70.	1870–'71.	1871–'72.
September	$0 40	$0 43	$0 43	$0 55
October	42	42	42	55
November	40	43	42	60
December	40	42	42	62
January	42	42	42	63
February	40	44	43	70
March	40	42	43	75
April	42	45	43	70
May	40	45	43	70
June	42	37	45	65
July	42	37	48	60
August	45	41	55	55

The annual receipts and shipments of wool during twenty-six commercial years were as follows:

Years.	Receipts.	Shipments.		Years.	Receipts.	Shipments.	
	Bales.	*Bales.*	*Pounds.*		*Bales.*	*Bales.*	*Pounds.*
1847	2, 960	2, 452	36, 710	1860	9, 513	10, 239	....
1848	1, 943	2, 268	7, 037	1861	7, 040	7, 593	....
1849	1, 688	1, 109	10, 230	1862	11, 597	10, 597	....
1850	1, 277	2, 156	15, 831	1863	8, 130	9, 780	....
1851	1, 866	2, 725	4, 836	1864	14, 005	12, 913	....
1852	4, 562	3, 454	2, 972	1865	11, 014	12, 953	....
1853	6, 748	9, 432	1, 586	1866	17, 099	15, 670	....
1854	4, 953	6, 439	14, 193	1867	15, 490	13, 995	....
1855	5, 999	6, 435	4, 482	1868	11, 851	12, 461	....
1856	6, 489	8, 691	....	1869	13, 827	15, 058	....
1857	6, 029	7, 180	....	1870	11, 971	15, 655	....
1858	3, 115	4, 586	....	1871	16, 728	19, 432	....
1859	8, 064	10, 169	....	1872	11, 082	12, 177	....

NOTE.—Since 1855 the shipments have been reduced to bales averaging 100 pounds each.

Hogs.—The receipts and shipments of hogs, reported at the close of each week in each month of the last two commercial years, were as follows:

Months.	1870–'71.		1871–'72.	
	Receipts.	Shipments.	Receipts.	Shipments.
September	11, 174	1, 800	48, 530	15, 802
October	21, 756	2, 427	60, 231	16, 966
November	109, 578	5, 958	187, 506	9, 429
December	239, 479	7, 850	306, 827	4, 928
January	124, 617	1, 167	120, 870	9, 608
February	22, 018	4, 915	44, 375	14, 531
March	11, 459	2, 890	32, 574	13, 796
April	10, 617	2, 212	39, 817	14, 503
May	22, 121	7, 397	43, 955	15, 223
June	45, 251	6, 384	53, 750	25, 020
July	38, 881	7, 977	25, 854	5, 546
August	28, 738	12, 311	40, 335	10, 138
Total	685, 689	63, 288	1, 004, 624	155, 490

The comparative net weight and yield of lard for thirteen years were as follows:

Year.	Average weight per head.	Average yield of lard per head.	Year.	Average weight per head.	Average yield of lard per head.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
1859–'60	189	23	1866–'67	$232\frac{2}{7}$	$30\frac{1}{2}$
1860–'61	$221\frac{1}{5}$	$28\frac{9}{16}$	1867–'68	$210\frac{3}{17}$	$25\frac{5}{28}$
1861–'62	$224\frac{23}{24}$	$29\frac{5}{18}$	1868–'69	$214\frac{6}{16}$	$25\frac{1}{6}$
1862–'63	203	$25\frac{21}{23}$	1869–'70	$226\frac{1}{3}$	$27\frac{1}{8}$
1863–'64	$188\frac{11}{12}$	$23\frac{1}{6}$	1870–'71	239. 07	31. 2
1864–'65	$201\frac{1}{8}$	$24\frac{1}{5}$	1871–'72	231. 36	29. 6
1865–'66	$238\frac{18}{31}$	$32\frac{13}{25}$			

Monthly range of prices of good hogs during the last two commercial years.

Months.	1870–'71.	1871–'72.
	Per cental gross.	*Per cental gross.*
September	....	\$4 00 to \$4 70
October	....	4 00 to 4 20
November	\$6 25 to \$7 40	4 00 to 4 50
December	6 20 to 6 55	4 10 to 4 70
January	6 00 to 7 90	4 25 to 5 00
February	7 50 to 7 90	4 30 to 5 00
March	....	4 40 to 4 90
April	....	4 00 to 4 50
May	....	4 00 to ——
June	....	3 85 to 4 00
July	....	4 00 to 5 00
August	....	5 00 to 5 10

The total number of hogs annually cut in Cincinnati during forty years were as follows: 1833, 85,000; 1834, 123,000; 1835, 162,000; 1836, 123,000; 1837, 103,000; 1838, 138,000; 1839, 90,000; 1840, 95,000; 1841, 160,000; 1842, 220,000; 1843, 250,000; 1844, 240,000; 1845, 196,000; 1846, 205,000; 1847, 250,000; 1848, 475,000; 1849, 410,000; 1850, 393,000; 1851, 334,000; 1852, 352,000; 1853, 361,000; 1854, 421,000; 1855, 355,786; 1856, 405,396; 1857, 344,512; 1858, 446,677; 1859, 382,826; 1860, 434,499; 1861, 433,799; 1862, 474,467; 1863, 608,457; 1864, 370,623; 1865, 350,600; 1866, 354,079; 1867, 462,610; 1868, 366,831; 1869, 356,555; 1870, 337,330; 1871, 481,560; 1872, 630,301.

Hog products.—The annual average prices of hog products during the past seventeen commercial years were as follows:

Years.	Mess-pork.	Lard.*	Bacon shoulders.	Bulk shoulders.	Bulk sides.
	Pr. bbl.	*Pr. lb.*	*Pr. lb.*	*Pr. lb.*	*Pr. lb.*
1855–'56	\$16 75	$10\frac{1}{8}$	$8\frac{8}{8}$	$6\frac{3}{7}$	$7\frac{2}{5}$
1856–'57	19 96	$12\frac{1}{2}$	$9\frac{1}{6}$	8	$9\frac{2}{3}$
1857–'58	16 35	$10\frac{1}{11}$	$7\frac{1}{4}$	$5\frac{1}{2}$	$7\frac{1}{20}$
1858–'59	16 61	$10\frac{5}{6}$	$6\frac{5}{6}$	6	$8\frac{1}{12}$
1859–'60	16 90	$10\frac{4}{5}$	$7\frac{7}{8}$	$6\frac{5}{6}$	$8\frac{3}{5}$
1860–'61	16 21	$9\frac{1}{10}$	$6\frac{5}{7}$	$5\frac{3}{6}$	$7\frac{3}{5}$
1861–'62	10 70	$7\frac{1}{2}$	4	$3\frac{1}{5}$	$4\frac{5}{6}$
1862–'63	12 46	$9\frac{1}{2}$	$4\frac{7}{11}$	$4\frac{1}{12}$	$5\frac{1}{5}$
1863–'64	23 29	$13\frac{1}{2}$	$10\frac{1}{2}$	$8\frac{3}{4}$	$10\frac{1}{4}$
1864–'65	32 75	$20\frac{1}{4}$	$16\frac{1}{2}$	$14\frac{1}{2}$	$14\frac{5}{8}$
1865–'66	30 20	$21\frac{1}{4}$	$15\frac{5}{8}$	$13\frac{1}{2}$	$15\frac{7}{8}$
1866–'67	23 $64\frac{1}{2}$	$13\frac{1}{4}$	$11\frac{3}{4}$	$9\frac{3}{4}$	$11\frac{1}{2}$
1867–'68	22 80	$15\frac{1}{4}$	$12\frac{1}{3}$	$11\frac{1}{2}$	$13\frac{3}{4}$
1868–'69	30 35	$18\frac{3}{8}$	$13\frac{1}{2}$	$14\frac{1}{8}$	$14\frac{3}{4}$
1869–'70	29 $37\frac{3}{4}$	$15\frac{1}{8}$	$13\frac{5}{8}$	$11\frac{7}{8}$	$14\frac{1}{4}$
1870–'71	19 44	$11\frac{3}{4}$	$9\frac{1}{8}$	$7\frac{1}{4}$	$9\frac{3}{8}$ †
1871–'72	12 89	9	$6\frac{1}{5}$	$5\frac{1}{7}$	$6\frac{2}{3}$ †

* Prime kettle in tierces.
† The quotations for the last two years are for clear rib—previously for rough sides.

The monthly range of weekly average prices of mess pork and lard during the last two commercial years was as follows:

Months.	Mess-pork per barrel. 1870–'71.	Mess-pork per barrel. 1871–'72.	Lard per pound. 1870–'71.	Lard per pound. 1871–'72.
September	$24 00 to $27 50	$12 37½ to $12 87½	$0 14½ to $0 15½	$0 08½ to $0 09⅛
October	24 50 to 26 00	12 50 to 13 00	14¾ to 16	8¾ to 9⅜
November	19 00 to 24 00	12 50 to 12 75	12½ to 14	8½ to 9½
December	18 25 to 19 25	13 25 to 13 87½	11 to 12	8⅜ to 9¼
January	19 00 to 22 00	13 12½ to 13 50	11¼ to 12⅜	9⅛ to 9½
February	21 75 to 22 37½	13 00 to 13 25	12½ to 12¾	9¼ to 9⅜
March	20 50 to 21 50	12 00 to 12 62½	11⅞ to 12½	8½ to 9
April	18 00 to 19 75	12 75 to 14 00	11 to 11¼	8½ to 9
May	16 00 to 17 50	14 00 to 14 50	10 to 10⅞	8½ to 9
June	15 00 to 15 75	12 00 to 15 00	9¾ to 10	8½ to 8⅞
July	12 75 to 15 12½	12 25 to 14 50	9¾ to 10¼	8½ to 9
August	12 25 to ——	13 25 to 14 00	8¾ to 9	8¼ to 8⅞

Receipts of hog products for the last twenty-six commercial years.

Years.	Pork and bacon.	Pork and bacon.	Pork.	Pork and bacon.	Lard.	Lard.
	Hogsheads.	*Tierces.*	*Barrels.*	*Pounds.*	*Tierces.*	*Kegs.*
1847	5,476	124	40,581	8,027,399	21,991	22,287
1848	4,420	140	69,828	9,643,063	37,978	42,722
1849	6,178	465	44,267	9,249,380	28,514	47,814
1850	7,564	2,358	43,227	1,325,756	34,173	61,131
1851	6,277	1,183	31,595	14,631,330	36,899	33,087
1852	10,333	1,987	22,501	16,532,884	36,037	36,382
1853	15,251	3,550	39,517	26,868,341	51,747	28,157
1854	12,164	2,736	39,387	27,059,927	76,094	19,753
1855	5,947	6,770	38,365	18,551,646	53,654	14,317
1856	9,734	7,513	26,292	16,482,452	79,505	14,763
1857	3,264	1,667	19,713	11,968,483	29,465	10,534
1858	5,399	1,487	22,291	19,613,113	46,651	8,629
1859	5,155	2,199	38,630	18,975,099	48,033	8,212
1860	4,662	3,882	25,456	23,250,222	47,499	11,319
1861	5,136	6,459	37,447	21,912,796	50,362	12,245
1862	10,082	3,879	46,903	28,708,694	99,085	33,582
1863	8,443	10,361	47,457	33,215,723	93,703	11,800
1864	5,353	7,178	41,412	20,169,052	58,328	5,327
1865	4,918	6,810	38,642	10,868,538	55,556	6,430
1866	4,850	5,242	28,443	11,700,879	41,879	7,976
1867	5,232	4,843	15,316	15,691,730	76,475	9,145
1868	2,247	5,168	16,610	18,386,343	41,600	4,693
1869	1,776	10,627	14,647	15,692,140	48,414	2,416
1870	1,633	9,073	11,462	17,386,497	25,326	1,469
1871	2,756	9,339	15,615	25,445,310	42,814	2,567
1872	3,329	9,423	32,078	38,073,386	46,779	2,809

Shipment of hog products for the past twenty-six commercial years.

Years.	Pork and bacon.	Pork and bacon.	Pork.	Pork and bacon.	Pork and bacon.	Lard.	Lard.
	Hhds.	*Tierces.*	*Barrels.*	*Boxes.*	*Pounds.*	*Barrels.*	*Kegs.*
1847	31,538	7,894	137,218		3,478,850	49,878	150,828
1848	37,162	8,862	196,186		759,188	81,679	208,696
1849	39,470	8,862	186,192		924,256	37,521	30,509
1850	23,529	10,930	193,581	13,488	2,310,699	39,192	170,168
1851	30,220	20,762	122,086	2,974	4,753,953	30,391	71,300
1852	43,633	34,398	131,560	2,372	3,912,943	47,862	115,848
1853	47,150	53,154	135,707	6,388	2,146,987	42,652	98,650
1854	49,230	51,778	134,939	18,806	1,939,148	57,087	84,647
1855	42,469	40,515	104,275	22,574	873,044	43,799	62,806
1856	34,005	41,819	110,869	25,603	1,115,220	31,838	50,388
1857	34,072	32,775	100,816	29,896	900,799	36,989	51,598
1858	43,247	34,648	113,594	21,318	618,358	53,384	53,571
1859	42,142	32,573	112,160	8,208	546,400	44,634	49,959
1860	52,532	39,833	104,347	19,101	345,932	60,658	55,701
1861	47,851	32,251	121,635	31,271	776,571	100,806	46,643
1862	39,458	40,965	86,363	76,549	2,038,393	139,596	61,352
1863	27,746	53,735	123,900	115,178	700,881	144,147	33,699
1864	34,759	31,549	136,126	36,422	1,810,875	82,836	13,028
1865	27,727	37,440	89,061	17,464	1,124,756	66,011	17,674
1866	36,256	30,236	113,204	12,298	1,798,798	98,403	33,495
1867	54,591	43,252	105,928	7,923	1,358,894	116,573	41,892
1868	40,626	41,051	91,186	9,600	5,054,315	116,046	44,838
1869	41,453	45,332	67,666	8,311	7,325,972	108,437	37,092
1870	39,206	45,681	66,437	9,800	7,223,236	57,337	74,693
1871	52,468	51,863	72,487	6,337	11,828,290	110,304	49,735
1872	69,838	76,515	93,985	14,835	19,758,909	125,002	36,286

CHICAGO.

Cattle.—The receipts and shipments of beef-cattle at the Union stock-yards during 1871 and 1872 were as follows:

Months.	1871.		1872.	
	Received.	Shipped.	Received.	Shipped.
January	30, 708	16, 639	44, 990	33, 047
February	43, 299	28, 782	41, 087	36, 146
March	44, 752	39, 573	53, 170	43, 705
April	48, 144	43, 522	58, 393	52, 474
May	59, 217	49, 455	71, 700	67, 039
June	52, 564	44, 637	63, 449	52, 335
July	50, 041	39, 754	58, 439	41, 928
August	50, 583	36, 007	64, 463	47, 211
September	53, 175	38, 528	66, 744	43, 179
October	37, 981	22, 759	64, 957	34, 388
November	42, 781	20, 378	55, 884	32, 468
December	29, 805	21, 893	40, 799	26, 105
Total	543, 050	401, 927	684, 075	510, 025

Increase of receipts, 141,025, or 27 per cent.; increase of shipments, 108,098, or 26 per cent.

The monthly averages of prices of beef-cattle during 1871 and 1872 were as follows:

Months.	1871.	1872.
	Per cental.	*Per cental.*
January	$2 71 to $6 00	$2 62 to $6 90
February	3 37 to 6 97	2 75 to 6 72
March	3 80 to 6 89½	3 21 to 6 86
April	3 66 to 7 45	3 17 to 6 86
May	3 43¾ to 6 39½	3 70 to 6 90
June	3 13 to 6 77	3 17 to 7 10
July	2 81¼ to 6 24	3 00 to 6 56¼
August	2 87½ to 6 15	2 60 to 6 93
September	2 33⅓ to 5 90	2 16 to 6 96
October	2 23¾ to 5 43	2 24 to 6 52
November	2 37 to 5 91	2 24 to 6 18
December	2 20½ to 6 82½	2 08 to 6 21

Cattle products.—The receipts and shipments of barreled beef, tallow, and butter during 1871 and 1872 were as follows:

	1871.		1872.	
	Receipts.	Shipments.	Receipts.	Shipments.
Beef ... barrels	53, 289	89, 452	13, 744	31, 991
Tallow ... pounds	5, 831, 000	6, 403, 842	5, 968, 943	5, 745, 849
Butter ... do	16, 301, 775	17, 186, 650	9, 691, 897	9, 491, 491

HOGS.

The receipts of December, 1872, were the largest ever known in any single month. The recent enhancement in the cost of transportation by the action of the various railroads leading to eastern markets had its effect in reducing shipments during the latter part of the year. The farmers who had been holding back for higher prices were convinced of the futility of their hopes by the downward turn of prices during the

last quarter of the year, and hence the increased number of hogs marketed in November and December. The average weight of hogs received during the year was 249¾.

Monthly receipts and shipments of hogs during 1871 and 1872:

Months.	1871.		1872.	
	Receipts.	Shipments.	Receipts.	Shipments.
January	300, 697	26, 530	361, 935	78, 337
February	139, 342	47, 724	268, 236	104, 668
March	97, 058	75, 387	170, 785	144, 209
April	71, 632	63, 986	169, 149	145, 151
May	137, 521	111, 524	265, 259	196, 451
June	197, 499	166, 513	254, 714	206, 940
July	165, 831	134, 391	212, 030	172, 934
August	118, 975	98, 187	219, 406	198, 077
September	164, 749	125, 561	214, 728	186, 010
October	161, 212	131, 370	229, 304	175, 241
November	386, 766	113, 643	373, 963	132, 381
December	456, 831	67, 490	513, 114	95, 195
Total	2, 380, 083	1, 162, 286	3, 252, 623	1, 835, 594

Average monthly prices per cental of hogs during the years 1871 *and* 1872.

Months.	1871.	1872.	Months.	1871.	1872.
January	\$6 26 to \$7 15	\$4 05 to \$4 46	July	\$4 06 to \$4 71	\$3 95 to \$4 33
February	6 97 to 7 68	4 00 to 4 40	August	4 10¼ to 4 72½	4 36½ to 4 87½
March	6 23 to 7 33	4 22 to 4 61	September	4 21¾ to 4 46	4 54½ to 5 13⅛
April	5 35 to 5 60	4 07 to 4 48	October	3 98 to 4 46	4 34 to 4 76
May	4 29 to 4 68	3 73 to 4 18	November	3 85 to 4 19	4 05¾ to 4 40
June	3 49½ to 4 02	3 59 to 4 03	December	3 89 to 4 36	3 60¼ to 3 94⅛

Hog products.—The receipts and shipments, during the years 1871 and 1872, of barreled pork, lard, and slaughtered hogs were as follows:

	1871.		1872.	
	Receipts.	Shipments.	Receipts.	Shipments.
Pork ... barrels	68, 949	149, 724	125, 241	190, 111
Lard ... pounds	17, 662, 798	61, 029, 853	18, 544, 261	82, 917 163
Dead hogs	272, 466	227, 984	169, 473	133, 764

Sheep.—The monthly receipts and shipments of sheep during 1871 and 1872 were as follows:

Months.	1871.		1872.	
	Receipts.	Shipm'ts.	Receipts.	Shipm'ts.
January	35, 111	17, 576	42, 069	23, 235
February	43, 608	25, 512	41, 803	25, 348
March	43, 213	29, 321	38, 170	29, 495
April	23, 379	13, 084	24, 771	17, 328
May	23, 337	8, 577	16, 389	5, 945
June	22, 667	6, 496	13, 776	3, 493
July	18, 022	5, 214	13, 819	2, 471
August	24, 471	6, 917	18, 777	3, 937
September	27, 732	7, 264	22, 452	5, 622
October	18, 632	4, 397	48, 290	7, 349
November	19, 144	3, 697	24, 343	7, 417
December	15, 737	7, 029	25, 552	13, 376
Total	315, 053	135, 088	310, 211	145, 016

Monthly range of prices during 1871 and 1872.

Months.	1871.	1872.	Months.	1871.	1872.
January	$3 00 to $5 00	$4 22 to $4 92	July	$2 62½ to $5 00	$3 62 to $4 81
February	3 00 to 5 70	4 37 to 7 30	August	2 73 to 5 04	3 71 to 5 32
March	2 87½ to 6 43	5 25 to 8 06	September	2 78 to 4 71	3 75 to 5 25
April	3 90 to 6 57	5 61 to 8 15	October	2 43¾ to 4 31¼	3 33⅓ to 4 64⅓
May	3 75 to 6 45	5 66 to 8 60	November	2 51 to 5 25	3 52 to 4 55
June	2 25 to 4 40	3 59 to 5 37½	December	2 80 to 5 10	3 52 to 5 24

The market was well supplied with fair qualities of mutton sheep.

Sheep products.—Receipts of wool during 1871, 27,026,621 pounds; receipts of wool during 1872, 28,290,989 pounds; shipments, 1871, 24,351,524 pounds; 1872, 25,833,447 pounds.

Horses.—During 1872, 12,145 horses were received and 10,627 shipped.

The receipts of live stock by rail during the year occupied 109,086 cars; the shipments, 54,275 cars. The values of farm animals received are estimated as follows: cattle, $41,000,000; hogs, $33,500,000; sheep, $950,000.

SAINT LOUIS.

Cattle.—The receipts of cattle show an increase over last year of 69,961. Both receipts and shipments were greater than in any previous year. The season for receiving Texas cattle commenced May 17, at least a month earlier than in the previous year. They came first in small droves, but increased in numbers as the season advanced. It is estimated that the increase in this class of cattle over 1871 amounted to 123,898. In the latter part of August the Texas cattle fever was developed among the native cattle, and was fatal to large numbers. This kept the latter out of market, and also had the effect of stopping large droves of Texans in transit to this market. The values of the latter consequently decreased. As to quality they were generally thin, rough, and but half fattened. Well-wintered and stall-fed Texans were in good request during the year, and at fair prices; others could be disposed of only to feeders and speculators. The receipts of "through Texans" were estimated at 211,108 against 87,210 in 1871. Good to choice wintered brought from $3.50 to $4.25 per cental; common to fair fresh, $2.50 to $3; inferior, $1.50 to $2.25.

The receipts of native or domestic cattle were mostly from Iowa and North Missouri. In numbers and quality they were about the same as last year, but the great bulk of this class of cattle went through to eastern markets in first hands. The irruption of Texas cattle so far reduced the prices of all grades of native cattle that shippers preferred the risks of eastern markets. Extra to choice native steers brought from $6.25 to $6.50 per cental; prime to choice, $5.75 to $6; fair to good, $4.25 to $4.75; common, $2.25 to $2.75; stock steers, $3.50 to $4.50.

The monthly receipts and shipments of cattle during 1872 were as follows:

Months.	Receipts.	Shipments.	Months.	Receipts.	Shipments.
January	14,444	8,716	August	34,420	21,127
February	14,090	9,953	September	32,024	16,000
March	12,065	9,979	October	34,757	20,671
April	13,090	9,869	November	25,778	14,545
May	13,493	8,382	December	15,257	12,227
June	25,929	18,702			
July	27,237	14,601	Total	263,404	164,772

Receipts and shipments of cattle for eight years past were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1865	94, 307	46, 712	1869	124, 565	59, 867
1866	103, 259	24, 462	1870	201, 422	129, 748
1867	74, 146	26, 799	1871	199, 427	129, 827
1868	115, 352	37, 277	1872	263, 404	164, 772

The highest and lowest prices of all grades during each month of 1871 and 1872 were as follows:

Months.	1871.	1872.	Months.	1871.	1872.
	Per cental.	*Per cental.*		*Per cental.*	*Per cental.*
January	$2 50 to $6 25	$2 25 to $5 50	July	$2 00 to $5 00	$1 75 to $6 50
February	2 50 to 6 50	3 25 to 5 75	August	1 75 to 5 00	1 75 to 6 25
March	2 75 to 6 50	3 50 to 6 75	September	1 25 to 4 75	1 75 to 5 75
April	2 75 to 6 70	3 50 to 6 75	October	1 50 to 4 50	1 25 to 6 00
May	2 62½ to 6 00	4 37½ to 6 50	November	2 25 to 5 00	1 50 to 6 00
June	3 00 to 6 75	2 50 to 6 50	December	1 50 to 4 75	1 37½ to 5 75

CATTLE PRODUCTS—*Butter:* The monthly receipts and range of prices per pound of butter during 1872 were as follows:

Months.	Receipts.	Prices, (good to choice.)	Months.	Receipts.	Prices, (good to choice.)
	Packages.			*Packages.*	
January	2, 593	$0 18 to 32	July	3, 944	$0 10 to 24
February	2, 288	19 to 33	August	4, 715	16 to 30
March	3, 436	19 to 40	September	4, 828	18 to 33
April	2, 768	18 to 40	October	6, 572	18 to 33
May	1, 622	18 to 25	November	7, 458	18 to 30
June	6, 335	15 to 20	December	3, 184	20 to 35

Hogs.—The monthly receipts and shipments of hogs during 1871 and 1872 were as follows:

Months.	1871.		1872.	
	Receipts.	Shipments.	Receipts.	Shipments.
January	112, 127	639	109, 611	23, 244
February	21, 319	1, 350	36, 301	12, 606
March	13, 033	6, 252	22, 104	14, 944
April	17, 689	9, 557	30, 129	20, 979
May	31, 107	14, 224	44, 176	29, 587
June	23, 322	9, 755	29, 315	14, 685
July	17, 170	4, 186	16, 935	5, 496
August	15, 030	4, 055	17, 399	10, 652
September	19, 801	6, 674	26, 773	8, 752
October	32, 226	16, 154	54, 168	18, 902
November	110, 656	19, 985	166, 144	14, 565
December	224, 305	20, 540	206, 021	14, 287
Total	632, 210	113, 655	759, 076	188, 693

Receipts and shipments of the eight years just closed were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1865	94, 307	17, 869	1869	344, 848	39, 076
1866	103, 259	13, 358	1870	310, 850	17, 156
1867	293, 241	28, 627	1871	632, 216	113, 655
1868	115, 352	16, 227	1872	759, 076	188, 693

The prices per cental, in 1872, were as follows:

Months.	At the beginning of each month.	Highest and lowest prices during each month.	Months.	At the beginning of each month.	Highest and lowest prices during each month.
January	$3 90 to $4 25	$3 60 to $4 50	July	$3 70 to $4 15	$3 70 to $4 60
February	4 00 to 4 60	4 00 to 4 85	August	4 00 to 4 90	4 00 to 5 25
March	3 75 to 4 75	3 75 to 5 10	September	4 00 to 5 25	4 00 to 5 40
April	3 75 to 4 80	3 50 to 4 80	October	4 00 to 5 25	4 00 to 5 25
May	3 50 to 4 75	3 25 to 4 75	November	3 50 to 4 25	3 50 to 4 25
June	3 50 to 4 50	3 40 to 4 50	December	3 35 to 4 15	3 25 to 4 15

The market was satisfactory in everything except prices, which gradually declined, making a general average of 25 per cent. less than last year. This was caused by the superabundant supply.

Hog products.—The number of hogs packed during the ten packing seasons, ending with 1871–'72, were as follows: 1862–'63, 178,750; 1863–'64, 244,600; 1864–'65, 191,890; 1865–'66, 123,335; 1866–'67, 183,543; 1867–'68, 237,160; 1868–'69, 231,937; 1869–'70, 241,316; 1870–'71, 305,600; 1871–'72, 419,032.

The average net weight of hogs packed during the above seasons was as follows: 1862–'63, 207 pounds; 1863–'64, 179 pounds; 1864–'65, 178½ pounds; 1865–'66, $208\frac{91}{100}$ pounds; 1866–'67, $222\frac{34}{100}$ pounds; 1867–'68, $193\frac{91}{100}$ pounds; 1868–'69, $189\frac{27}{100}$ pounds; 1869–'70, 190½ pounds; 1870–'71, 216 pounds; 1871–'72, $210\frac{52}{100}$ pounds.

The average yield of lard per head, of all kinds of hogs, was $35\frac{17}{100}$ pounds.

Pork.—The monthly receipts and range of prices of barreled pork during 1872 were as follows:

Months.	Receipts.	Prices per barrel.	Months.	Receipts.	Prices per barrel.
	Barrels.			*Barrels.*	
January	2,060	$12 75 to $13 75	August	2,056	$13 25 to $14 50
February	750	13 00 to 13 62½	September	431	14 25 to 15 00
March	9,324	11 75 to 13 25	October	2,265	15 00 to 16 00
April	17,671	11 50 to 12 50	November	3,906	13 00 to 16 50
May	9,629	12 00 to 13 62½	December	1,461	11 75 to 13 00
June	6,665	11 75 to 12 75			
July	2,034	11 75 to 14 00	Total	58,252	

Receipts and exports of pork for twelve years.

Years.	Receipts.				Exports.			
	Barrels.	Casks and tierces.	Boxes and packages.	Pieces.	Barrels.	Casks and tierces.	Boxes and packages.	Pieces.
1861	116,445	11,358	....	751,313	....	....	....	....
1862	51,187	6,515	....	487,580	....	....	....	....
1863	34,256	3,558	....	865,287	....	....	....	....
1864	71,559	4,709	....	724,161	....	....	....	....
1865	66,822	11,224	4,930	338,223	109,702	3,503	6,949	525
1866	56,740	3,203	4,082	343,202	92,595	6,553	3,414	379
1867	92,071	7,764	4,078	730,461	138,226	8,001	3,096	483
1868	85,127	5,677	2,266	947,918	130,228	3,467	1,384	25,644
1869	78,236	5,818	2,057	1,013,291	120,002	5,712	3,119	10,896
1870	77,398	7,837	1,186	848,490	115,236	9,972	3,466	12,128
1871	88,442	4,922	2,321	1,014,054	131,732	11,681	3,423	46,562
1872	58,252	8,264	3,088	1,329,629	114,329	20,609	5,035	169,526

Receipts and exports of bacon for twelve years.

Years.	Receipts.			Exports.		
	Casks and tierces.	Boxes and packages.	Pieces.	Casks and tierces.	Boxes and packages.	Pieces.
1861	11, 790	10, 820	106, 000	....	....	....
1862	10, 833	10, 352	106, 315	....	....	....
1863	7, 167	8, 862	230, 092	....	....	....
1864	8, 843	8, 888	170, 998	....	....	....
1865	7, 971	2, 200	62, 496	36, 297	27, 955	1, 114
1866	12, 421	3, 630	50, 103	23, 443	25, 505	2, 876
1867	11, 752	4, 825	58, 004	37, 127	30, 296	1, 038
1868	7, 505	2, 845	85, 944	44, 427	28, 278	11, 095
1869	5, 929	3, 970	69, 197	47, 942	19, 700	6, 894
1870	6, 264	3, 678	83, 569	45, 413	19, 211	11, 133
1871	14, 084	5, 522	148, 491	73, 019	37, 354	47, 760
1872	7, 116	7, 077	102, 733	79, 819	34, 276	148, 266

The monthly range of prices of bacon and hams during 1872 was as follows:

Months.	Shoulders.	Clear rib sides.	Clear sides.	Hams.
January	$0 06⅓ to $0 07¼	$0 07¼ to $0 07½	$0 07½ to $0 07¾	$0 12 to $0 13
February	6 to 6½	7⅜ to 7¾	7⅝ to 8	12½ to 13
March	4⅞ to 6	7 to 7⅜	7 to 7¾	12 to 13
April	4¾ to 5¼	6¾ to 7¼	7 to 7⅝	11½ to 12½
May	5¼ to 5½	7¼ to 7⅝	7½ to 8	11½ to 13
June	4⅞ to 5⅝	7⅛ to 7¾	7⅜ to 8	11½ to 13
July	5¼ to 6¾	7½ to 8¾	7⅜ to 9	12 to 16
August	6⅝ to 7¾	8¾ to 10¼	9 to 11	14½ to 18
September	7½ to 8¾	10¼ to 11¾	10½ to 12¼	17 to 18½
October	7¼ to 8¼	11½ to 12	11⅝ to 12¼	17 to 18½
November	6¼ to 7¼	9¼ to 11¾	9⅝ to 12	15 to 18
December	5⅓ to 6	7½ to 9	8½ to 9½	12½ to 15½

The monthly range of prices of dry salt meats during 1872 was as follows:

Months.	Shoulders.	Clear rib sides.	Clear sides.
January	$0 05 to $0 05¼	$0 06⅛ to $0 06⅞	$0 06½ to $0 06¾
February	4¾ to 5¼	6⅜ to 6¾	6½ to 7
March	4 to 5	6 to 6½	6¼ to 6¾
April	4 to 4½	6¼ to 6⅝	6¼ to 7
May	4½ to 5	6½ to 7	7 to 7½
June	4 to 6	6⅜ to 6⅝	6⅝ to 7
July	4⅝ to 5⅞	6⅝ to 7⅞	6¾ to 8
August	5¾ to 7¼	7¼ to 8	8 to 8¼
September	6¾ to 7½	....	....
October	6⅜ to 6½	9¼ to 10½	9¾ to 11
November	4¼ to 6¼	6⅝ to 8	6¾ to 8¼
December	3½ to 4¼	5⅜ to 6¼	5⅞ to 6½

Lard.—The monthly receipts and range of prices of lard during 1872 were as follows:

Months.	Tierces.	Prices per pound.	Months.	Tierces.	Prices per pound.
January	5, 546	8¼ to 9¾	August	440	8 to 10½
February	3, 606	8 to 9	September	208	8 to 10¾
March	5, 930	8⅓ to 9½	October	799	8 to 10½
April	2, 576	8 to 9¾	November	498	7¾ to 10
May	812	8⅜ to 10¼	December	3, 670	6¾ to 8¾
June	846	8 to 10½			
July	111	8 to 10	Total	25, 042	

The receipts and exports of lard for twelve years were as follows:

Years.	RECEIPTS.				EXPORTS.			
	Tierces.	Barrels.	Kegs.	Packages.	Tierces.	Barrels.	Kegs.	Packages.
1861	27, 231	12, 877	....	11, 818	....	....	....	....
1862	19, 497	21, 975	....	5, 993	....	....	....	....
1863	15, 984	17, 505	2, 717	4, 501	....	....	....	....
1864	23, 676	5, 665	2, 471	1, 089	....	....	....	....
1865	16, 296	3, 652	2, 084	4, 643	21, 179	8, 515	8, 758	7, 924
1866	10, 997	4, 316	7, 238	2, 625	15, 083	3, 914	28, 651	6, 058
1867	16, 511	5, 105	13, 567	1, 873	34, 853	5, 080	35, 424	4, 513
1868	13, 159	4, 714	9, 358	3, 619	33, 168	2, 401	32, 526	3, 064
1869	19, 894	3, 641	6, 326	5, 172	33, 384	3, 384	33, 355	4, 079
1870	15, 619	2, 769	6, 100	5, 504	35, 353	3, 741	50, 000	16, 689
1871	24, 317	6, 999	5, 889	8, 156	79, 729	9, 263	50, 584	11, 550
1872	27, 481	7, 544	5, 745	9, 452	89, 002	5, 064	61, 492	24, 478

Sheep.—The monthly receipts and shipments of sheep during 1872 were as follows:

Months.	Receipts.	Shipments.	Months.	Receipts.	Shipments.
January	5, 763	716	August	13, 844	2, 802
February	8, 578	4, 625	September	19, 570	2, 230
March	8, 207	3, 906	October	16, 290	5, 113
April	6, 430	2, 290	November	4, 427	1, 009
May	8, 089	1, 043	December	4, 394	2, 400
June	10, 166	1, 852			
July	10, 146	1, 554	Total	115, 904	29, 540

Receipts and shipments of the eight years just closed were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
1865	52, 133	8, 680	1869	96, 626	12, 416
1866	64, 647	15, 194	1870	94, 477	11, 649
1867	62, 974	19, 022	1871	118, 864	38, 465
1868	79, 315	6, 415	1872	115, 904	29, 540

Prices per cental at the beginning of each month of 1872 were as follows: January, $3.25 to $5.50; February, $4 to $6; March, $2.50 to $6.50; April, $4 to $7.25; May, $4 to $4.75; June, ——; July, $1.50 to $5; August, $3 to $5; September, $2 to $5; October, $2 to $5; November, $2.75 to $5; December, $2.75 to $5.

The market exhibited no important fluctuations, but a steady advance during the year. Good mutton was in request during the whole year. The advanced prices of wool limited the number of sheep available for the meat market. Large numbers in the market were brought by raisers and feeders.

SHEEP PRODUCTS.—*Wool:* The monthly range of prices per pound of tub-washed and unwashed wool, during 1872, was as follows:

Months.	Tub-washed.	Unwashed.	Months.	Tub-washed.	Unwashed.
January	72 to 79	40 to 50	July	55 to 71	40 to 55
February	78 to 85	46 to 50	August	53 to 63	33 to 43
March	80 to 85	40 to 50	September	52 to 60	32 to 38
April	68 to 80	43 to 50	October	50 to 58	28 to 37
May	68 to 75	47 to 52	November	50 to 67	28 to 43
June	65 to 72	45 to 55	December	50 to 68	30 to 43

Sheep-pelts.—The monthly range of prices of sheep-pelts during 1872 was as follows: January, $2.50 to $2.75; February, $2.50 to $3.50; March, $3 to $3.50; April, $2.50 to $3.25; May, $2.50 to $3; June, $2 to $3; July, $2.25 to $2.55; August, ——; September, ——; October, $1 to $1.25; November, $1 to $1.40; December, $1.25 to $1.75.

PORK-PACKING IN THE WEST.

According to the record kept by the Cincinnati Price Current, the number of hogs packed during the twenty-two packing seasons prior to the present were as follows: 1849–'50, 1,652,220; 1850–'51, 1,332,867; 1851–'52, 1,182,846; 1852–'53, 2,201,110; 1853–'54, 2,534,770; 1854–'55, 2,124,404: 1855–'56, 2,489,502; 1856–'57, 1,818,468; 1857–'58, 2,210,778; 1858–'59, 2,465,552; 1859–'60, 2,350,822; 1860–'61, 2,155,702; 1861–'62, 2,893,666; 1862–'63, 4,069.520; 1863–'64, 3,261,105; 1864–'65, 2,422,779; 1865–'66, 1,785,955; 1866–'67, 2,490,791; 1867–'68, 2,781,084; 1868–'69, 2,499,873; 1869–'70, 2,635,312; 1870–'71, 3,695,251; 1871–'72, 4,831,558.

At the time when this report was sent to press the record for the packing season of 1872–'73 had not been made up, the statistics of Chicago and Saint Louis not having been completed. Using the most reliable estimates of the business of these important points, the results of the season just concluded may, with very close approximation, be given as follows:

States.	1871–'72.	1872–'73.	States.	1871–'72.	1872–'73.
Ohio	834, 163	863, 117	Kentucky	342, 562	329, 156
Indiana	566, 134	608, 336	Tennessee	40, 180	35, 000
Illinois	1, 620, 375	1, 794, 382	Other States	42, 281	63, 450
Iowa	288, 580	326, 397			
Missouri	693, 949	909, 080	Total	4, 831, 558	5, 321, 028
Kansas	43, 034	42, 800			4, 831, 558
Wisconsin	334, 410	319, 700			
Minnesota	21, 000	22, 000	Increase		489, 470
Nebraska	4, 890	7, 610			

In the above figures the number for the current season is made up only from the points reported the previous season. To the aggregate should be added about 100,000 hogs packed at points not previously reported, making the aggregate for 1872–'73, 5,421,028.

The number packed at the leading points in the United States during the last three seasons was as follows:

	1870–'71.	1871–'72.	1872–'73.		1870–'71.	1871–'72.	1872–'73.
Chicago	918, 087	1, 225, 236	1, 400, 586	Saint Joseph and vicinity	74, 360	118, 155	88, 082
Cincinnati	500, 066	656, 841	626, 305	Kansas City		83, 000	187, 221
Saint Louis	305, 600	419, 032	550, 000	Peoria		96, 225	104, 756
Louisville	242, 135	309, 512	302, 246	Keokuk		57, 500	71, 156
Milwaukee	241, 000	315, 000	303, 500				
Indianapolis	105, 000	172, 100	196, 317				

Near the close of the season it was estimated by leading pork authorities that the increase of weight per hog averaged about five pounds. An increase in the lard product was also partially indicated, but the low prices prevailing during the latter part of the season it was thought would check this upward movement and reduce the aggregate yield to about the figures of the previous year.

The amount of work accomplished by this division, during the past year, in the preparation of special statistical statements for the use of committees of Congress, boards of agriculture, and rural associations of many kinds, and for public use by representative individuals, has been

unusually large. The pressure of this class of our statistical work has in fact prevented the completion of important lines of investigation, the results of which might otherwise have appeared in this report.

J. R. DODGE, *Statistician.*

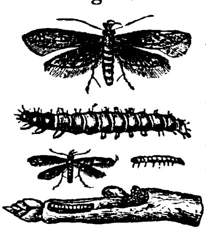
HON. FREDERICK WATTS, *Commissioner.*

REPORT OF THE ENTOMOLOGIST AND CURATOR OF THE MUSEUM.

SIR: During the past year a large number of letters were received from correspondents in various parts of the country containing insects destructive to vegetation, many of which have already been figured and described in the reports of the Department of Agriculture; a monthly record, however, has been kept of all that were new or interesting, and these have been figured and published with as much of their natural history, habits, &c., as is known. In addition, a chapter on the remedies, the present part embracing the Diptera, or two-winged flies, has been appended, which may prove very useful to the agriculturist for reference, as some of our most destructive insect pests are found in this order, as for example the wheat-midge, the Hessian fly, the onion-fly, &c.

In examining peach-orchards in the neighborhood of the Maryland Agricultural College, about the first week of May, almost all the young twigs of the trees were observed to be killed at the extreme point or end for a distance of 1 to 2½ inches, and the terminal buds entirely destroyed. On cutting open these dying twigs, the injury was found to be caused by a very minute caterpillar, which, entering the twig near a bud, had entirely eaten out the pith and interior, leaving only its "frass" and the exuding gum to mark the spot where it had entered. When confined in a glass case, after about a couple of weeks, several of the larvæ left the injured twigs and formed very loose cocoons on the sides of the box or among the rubbish and old leaves lying scattered on the earth, and in about six to ten days the perfect moth appeared. Specimens were forwarded to Mr. V. P. Chambers, of Covington, Kentucky, who is making a special study of our micro-lepidoptera, and he decided it to be *Anarsia* (Zeller) *pruinella*, (Clemens,) probably *A. lineatella* (Zeller) of Europe, (Fig. 1,) the larva of which was described by Mr. Clemens as taken June 16, full grown, and about to transform on the limbs of a plum, but no food-plant is mentioned. The tail of the pupa is attached to a little button of silk, in an exceedingly slight cocoon. There was scarcely a single young tree in the peach-orchard examined that was not more or less injured by this little pest, and at least as many as twenty to fifty injured twigs were found on some very young trees. After the insect leaves, the twig the injured part dries up and breaks off. This insect was also seen, though in much smaller numbers, last season, in Maryland and Virginia, and apple-trees are also frequently observed injured in a similar manner in Maryland, and it is probable that the damage is done by the same worm, but, as we have not yet succeeded in breeding them from the apple, we cannot say with certainty.

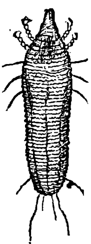
Fig. 1.



The larvæ are about 0.25 of an inch in length, head black, body dark reddish brown, with lighter rings, the third ring being more conspicu-

ous and whitish; the moth is quite small, and measures 0.40 to 0.60 of an inch in expanse of wings, and is of a pale-gray color, with a few blackish spots on the upper wings. Should this insect increase in numbers as much during the next year as it has done since the last, it threatens to be a great scourge to peach-growers. The only way to destroy them is to go around the peach-orchard in May and June and cut off such terminal shoots as appear to be withering or drying up, and then burn them with the caterpillars inside. This at least would prevent their multiplying to such an extent as to be very injurious at present. When not so very numerous, they appear only to serve to somewhat prune the trees, as they take off merely the tips of the branches.

Fig. 2.



In May many leaves of the pear-tree were observed to be covered with dark-brown blotches somewhat like a fungoid growth, but upon examination by Mr. Taylor, microscopist of the Department, these blotches were found to be inhabited by myriads of small mites almost invisible to the naked eye. These mites appear to run all over the leaves, but especially to burrow in the brown patches, which appear to be entirely eaten out by them. Their bodies are long, cylindrical, yellowish white, with only two pairs of legs, placed very far forward near the head, and they move with considerable agility. They are also marked with a multitude of rings, and have two long hairs or bristles and two shorter ones on the end of the abdomen. There is a somewhat similar mite mentioned by Packard as the *Typhlodromus pyri*, of Sheuten, which is said to live under the epidermis of pear-leaves in Europe, but no mention is made of the brown blotches on the leaf, apparently formed by the mite. In his figure also the head is much more obtuse than those examined in the Department. A thorough drenching with whale-oil-soap suds would doubtless destroy many of them, as their bodies appear to be very soft. All infested leaves, likewise, should be immediately removed and burned as soon as discovered.

Mr. Richard H. Day, Baton Rouge, Louisiana, wrote to the Department July 8, inclosing a specimen of a beetle that he had reared from infested branches and fruit of the peach, and, according to his letter, the entire leaves and fruit put up in the bottle were literally devoured when he removed them. He also stated that the peach crop was rotting badly before maturity, and asked if the insect could have connection in any way with this condition of the crop.

In a letter written August 19, however, he says that "although numbers of my trees show evidence of disease, it certainly cannot be traced to the ravages of this insect." He further states that "the ravages of the insects were first noticed last spring in going through the orchard to prune." His attention was attracted by the great number of small branches dead and dying since the spring's growth had started, and upon tracing those branches down he invariably found in the branch at the base of the leaf a puncture covered over with dried gum. Sometimes the puncture was so recent that only the first leaf above was dead or dying, but death always followed the branch from the puncture up to its extremity, and almost as invariably traveled down till it came to a lateral branch, where the poison seemed to be arrested. It was observed that these punctures were always either in the tender wood of the preceding fall's or present spring's growth.

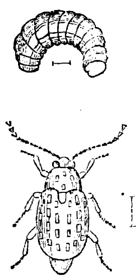
He examined many of the diseased branches with all possible care, and though he was unable to find either insect or eggs, he was satisfied that the injury could be traced to insects, and so a number of specimens of twigs, or terminal shoots, were forwarded to the Department.

These were carefully examined, and no eggs or insects could be discovered in the twigs. Mr. Day was advised, however, to put a number of injured specimens in a glass jar, and watch them carefully to see if any insects came out of them. This he did, but placed some twigs with young fruit on them. After watching them for a number of weeks he paid no further attention to them, supposing the insects had all escaped before he placed the branches in the jar; but later in the season, having occasion to use the jar, he found a number of small beetles, and discovered to his surprise that the leaves and fruit were nearly eaten up. One of these, the others escaping, he sent to the Department for identification.

On the 29th of August he wrote again to the Department, stating that he placed four specimens of diseased peaches in an empty quinine-bottle, with a view of determining whether his opinion was correct "in ascribing this general and wide-spread disease of peaches to the depredation of insects, and also whether this insect is the same as the one that commits its ravages upon the tender branches of the trees in the spring."

On the 27th of the month the first beetle appeared from this lot of specimens, and he subsequently sent the bottle, with peaches and insects inclosed, to the Department for examination by the entomologist. On examination, these beetles were decided to be *Aræocerus* (Sch.) *coffēæ* of Fab., and the shriveled peaches sent were literally riddled by their larvæ, a specimen of which was sent in June, and is figured, (Fig. 3.) Six perfect beetles made their appearance from the three specimens of the dried fruit last forwarded; but the insect first mentioned as attacking the twigs in spring is most probably another insect, and may prove to be the *Anarsia pruinella*, of Clemens, mentioned (with figures) on page 305 of the monthly report for July, as having injured peach-twigs in Maryland.

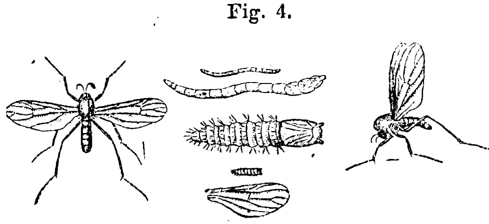
Fig. 3.



Another season, however, will decide the question, if Mr. Day, or any of our correspondents in Louisiana, or elsewhere, will send specimens of the twigs, as soon as injured in the spring, when one may be able to detect the insect. It appears to us that the *Aræocerus coffeæ* would not be likely, in the larvæ state, to injure living healhty twigs in the manner described. The insect, however, may probably be found under the bark of diseased trees, and there is no doubt whatever that, in the larvæ state, it attacks partially rotten and shriveled fruit, as proved by the worm-eaten appearance of the specimens sent.

A correspondent of the Department, when examining his peach-trees for the peach-tree borer, discovered a great quantity of small whitish worms, about the 0.40 of an inch in length, and of a very slender form, swarming in the exuded gum, saw-dust, and feces with which the mouths of burrows made by the peach-borer *Ægeria exitiosa* were filled. These small worms he considered the young larvæ of the borer, and sent them to the Department for examination; they were carefully placed in a bottle and fed until they changed into naked pupæ on the surface of the earth, or a little below it; and in about eight

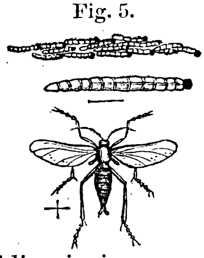
Fig. 4.



or ten days after the pupæ were fully developed, the perfect insects made their appearance in the form of minute two-winged dark-colored flies, which were at once recognized as the *Mycetobia* (*Mycetophila*) *persicæ*.. (Fig. 4.) Several of this genus feed upon fungi, and one species, very similar, is mentioned by Dr. Packard as living in the putrescent sap under the bark of elm trees. Our correspondents, however, have no occasion to apprehend any injury from this insect, as it only appears to feed upon the exuded gum, &c., and has nothing to do with the larvæ of the peach-tree borers, which, even when very young, can be readily distinguished by their heads, their more robust forms, and by their six small feet on the first three segments of the body—while the larvæ of the *Mycetobia* is long and snake-like in form, has no feet whatever, and is perfectly innocuous to the peach-tree.

A letter was received in the latter part of July from a correspondent, Mr. C. Moralle, of Leesburgh, Virginia, containing a number of very small white worms, or larvæ, having distinct black heads. These worms appeared to be clinging to each other by means of a viscid substance on the surface of their bodies, and formed a small living mass. In the accompanying letter Mr. Moralle stated that what attracted his attention was "the peculiarity about them that they gathered in a long string, resembling a snake, piling themselves up thickly in the middle and tapering at each end, and when they moved the whole mass moved as in one body." Unfortunately these worms were all dead when they arrived, but Mr. Saunders, of this Department, brought a mass of similar larvæ a few days afterward, which had been given him by a gentleman also in Virginia. These specimens were placed in a glass jar, having a small quantity of damp soil at the bottom, and retained their ball-shaped form for some time, and then commenced to creep round the sides of the jar on the earth in a string, three or four abreast, and continued traveling for a couple of hours; they then dispersed and buried themselves a short distance under the surface of the earth, and changed into pupæ, appearing six or eight days afterward as perfect flies. These were about one-tenth of an inch in length, (expanse 0.13,) of a dusky-black color, with dark brown legs and dusky-wings. Upon examination they proved to be a species of *Sciara*, (Fig. 5,) the larvæ or worms of which usually feed upon decaying vegetable substances, and are frequently found in fungi. The species above mentioned as occurring in Virginia is very similar in habits to a European species, *Sciara thomæ*, which is usually called the snake or army worm in Germany, from its habit of sometimes assembling in innumerable numbers, creeping among and over each other, and hanging together by means of a viscid moisture, and forming a mass like a snake or rope, sometimes several feet in length, and two or three inches in breath. The fly of the European species, *Sciara thomæ*, is described as having yellow stripes or points on the abdomen, whereas our American species (at least when dried) does not show any vestige of yellow whatsoever on the abdomen, but is of a uniform dark-brown color, although the worm or larva has the same habits of forming snake-like processions. It is somewhat singular that these worms appeared almost simultaneously in two places in Virginia, while no mention is made of their appearing elsewhere.

Fig. 5.



These insects (*Sciara*) generally do no damage to cultivated vegetation, although one species, *Sciara* (*Molobrus*) *mali*, is mentioned by Dr. Fitch as being found in the interior of apples, especially when pierced

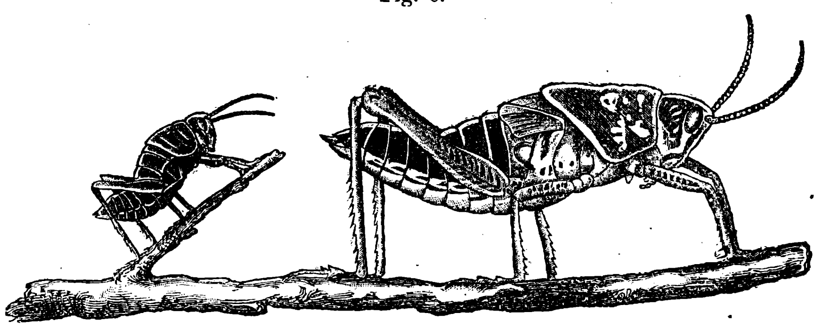
or eaten out by the codling moth, (*Carpocapsa pomonella*,) or other insects, where they merely accelerate the decay of fruit already previously injured. In Europe the larvæ of other species, *Sciara fucata*, and *quinque maculata*, live in putrid or decaying turnips, &c., and have been accused of producing the disease in potatoes commonly known as the "scab." *Sciara pyri* is said to deposit its eggs in the yet unfolded pear-blossoms, the larvæ of which, when hatched, work themselves down to the core, causing the young and yet undeveloped fruit to wither and fall to the ground.

The species found in Virginia probably does no injury to cultivated plants, but feeds on putrid vegetable substances, under bark of trees, moss, or stones, and in decaying fungi, as a very similar larva not yet developed into the perfect fly has lately been taken near Washington, feeding by hundreds on the under side of a species of fungus or agaricus, (allied to *Amanita muscaria*,) which was completely riddled and destroyed by them. If this is the case in one instance, may it not be probable that these larvæ, when in such multitudes as to entirely destroy the fungi upon which the eggs were deposited and the young larvæ had previously existed, may find it necessary to emigrate in swarms in search of fresh fungi to feed upon?

In regard to this singular worm Mr. M. H. Spera, a few months later, wrote, from Ephratah, Pennsylvania, as follows: "During the past summer I found several of these 'snakes,' one of them, when found, measuring 18 inches in length, and numbering 497 worms, some being .30 of an inch in length. It was moving rapidly. Several days after, I found another, not as large as the former, containing 364 worms. Of these I secured a number, placing them in a glass box, in which I also placed damp earth and moss. When I placed them in the box, about 3 p. m., they would crawl on the glass, but by next morning they had all disappeared beneath the earth and moss. The perfect flies appeared on the afternoon of the fifth day, and on the sixth and seventh, their description perfectly agreeing with that given in the monthly report. The first was found on the 27th of July, the second several days after."

A letter has been received from a correspondent in Louisiana, complaining of the injury done to the truck-farmers by a large grasshopper, which, from his description, appears to be the *Romalea microptera* (of Serville,) or the *Gryllus centurio* of Burmeister. He states that the insect has been known for forty years, appearing in May along the South Atlantic and Gulf coast. "Heretofore," he says, "it has been comparatively harmless, but this year it was very injurious to melons

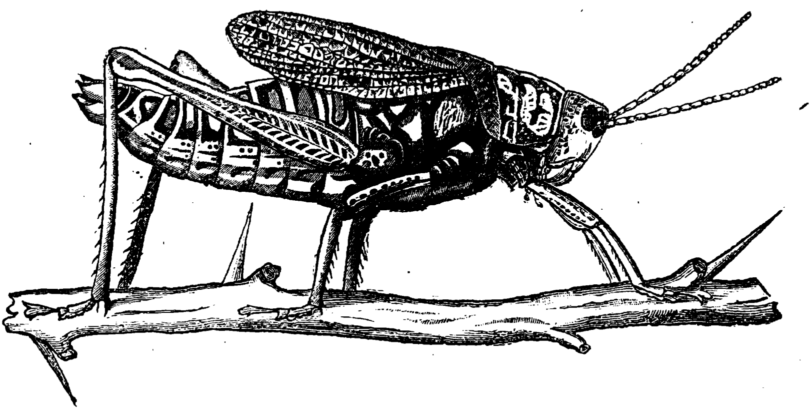
Fig. 6.



and vegetables; it also climbed peach and fig trees to devour the fruit; it cannot fly, as its wings are too short."

The insect was described in the Agricultural Report for 1858, as occurring in Florida, where it was commonly known as the "lubber," from its sluggish habits. It was very voracious, and was quite destructive in the young orange-groves by devouring the leaves. The insects also destroy many garden-vegetables and plants, though they were not especially destructive to them at that time and place, but appeared to be more injurious to the foliage of the orange-tree. They crawl slowly over the ground or upon shrubs, and are so nauseating that even fowls reject them as food. The eggs are probably deposited in the earth; the young larvæ are striped like the mature insects, but are perfectly wingless; they are of a black color, beautifully striped and banded with orange or red; the pupæ also are black, shaded, and striped on the thorax with yellow or orange red, and the abdomen is banded, and the hind thighs bordered with the same color. The insect, when fully grown, is from 2 to 2.50 inches in length, and is of a yellow or orange color, barred and spotted with black.

Fig. 7.



The wing-cases are extremely short, reaching only half way to the extremity of the abdomen, and are totally useless to the insect for the purpose of flight. These wing-covers are yellowish, shaded with rosy-pink, and are barred and spotted with black. The insects are extremely voracious, and from their large size are able to consume an immense quantity of food, and no doubt, if found in great numbers, would do immense injury in market-gardens; but as they never fly, merely creeping or jumping heavily, they can be readily destroyed by catching in a net, or by crushing with the foot, in every stage of their existence. It would, however, be well to destroy them when very young, as if allowed to grow they will consume as much as half a dozen common grasshoppers (*Caloptenus*) at one meal.

Numbers of letters have been received by the Department from the Western and Southwestern States during the past season complaining of the injury done to fruit-trees by a small insect, which bores into the wood and frequently destroys the branch or twig attacked. For some time the injured branches only were sent, but at last Mr. William Duane Wilson, of the Iowa Homestead, forwarded some branches of the grapevine with the insects in them, and on examination they proved to be the apple-twig borer, *Amphicerus* (*Bostrichus*) *bicaudatus* of Leconte. These insects measure from .25 to .35 of an inch in length, and are small,

dark chestnut-colored beetles, of a cylindrical form, having the front part of the thorax roughened with elevated points, the male having two little horns, and the tips of the wing-covers above, provided with two prickle-like points curving inward. In his letter Mr. Wilson complains much of the injury done by these insects in Iowa, and says that seven to nine year old vines are killed from the root up, and that out of fourteen vines, eleven were killed. Mr. Allen Crocker, of Burlington, Kansas, some time ago stated that in Kansas this insect did much damage by boring into the twigs of the white hickory. Other correspondents say that it also attacks apple, pear, and cherry trees in a similar manner, by boring into the twigs and young branches. It is in the perfect or beetle state that the insect does the injury to our fruit and forest trees, boring into the twig just above the bud, working downward sometimes to the depth of two or more inches through the pith, thus finding in the branch both food and protection. Even in mid-winter both male and female beetles may sometimes be found hiding in their cylindrical burrows, and always with the head directed downward. The insects are plentiful in the Western States, and, although they have been taken in Maryland and Pennsylvania, we have received no accounts of their ravages from eastern correspondents. The only remedy that can be suggested, when the insect attacks twigs and branches, is to cut them off some distance below the place injured and to burn them immediately, with the beetles inside, as it is not likely that any preparation could be applied to the trees that would prevent their attacks.

Fig. 8.

Extensive injuries by insects were reported in August in nearly all the cotton States. North Carolina, however, was thought to be nearly exempt from this infliction, a single mention of "insects in cotton" coming up from Pasquotank County. The August crops of Richland County, South Carolina, were generally swept by the cotton-caterpillar or cotton army-worm, (*Anomis xylinæ.*) In Georgia the ravages of this insect were reported in Lee, Marion, Glynn, Stewart, Clay, Glascock, Calhoun, Schley, and Baldwin Counties. In some places the destruction was complete. In Schley County fields were entirely denuded within forty-eight hours after the appearance of the enemy. In Glascock and Marion the boll-worm (*Heliothis armigera*) added its destructive influence. In some localities the grass caterpillar or grass army-worm (*Prodenia autumnalis*) devoured the corn, grass, and pea crops.

In Suwannee County, Florida, cotton-caterpillars appeared July 15, and within a month entirely swept many fields. In Leon they appeared August 18, and within a week the last cotton-leaf had disappeared. The same report comes from Taylor County. In Jefferson the third brood was in process of incubation. Similar complaints were received from Gadsden, Marion, and West Florida generally. The grass-caterpillars were numerous and active in Columbia and Manatee.

Returns from Alabama foreshadowed an extensive visitation of the cotton-caterpillar, which, as our September reports show, was fully and painfully realized. In some places the boll-worm vied with the cotton-worm in its destructive influence. Reports of either or both of these pests come from Macon, Clarke, Pike, Marengo, Conecuh, Perry, Montgomery, Crenshaw, Russell, Fisk, Calhoun, Chambers, Butler, Autauga, Dallas, Wilcox, and Tuscaloosa Counties. In Crenshaw entire fields were denuded of foliage. In Calhoun the crop prospect was reduced 25 per cent. in five days. In Autauga the roads, woods, and wells were full of army and boll worms. In Wilcox the caterpillars, after stripping

the cotton-plant of its leaves, attacked the bolls, eating the smaller ones and killing the larger ones by gnawing around them. In Perry the crop was cut down to half an average after August 20. In Fisk the boll-worm was also destructive in corn-fields.

In Mississippi the injuries reported by our correspondents, though less extensive than in Alabama, were quite considerable. Persistent efforts for the destruction of cotton-insects appear to have been measurably successful in several counties. Reports of injuries were received from Pike, Jasper, Newton, Clarke, La Fayette, Wilkinson, Warren, Smith, Attala, Lauderdale, Wayne, Hinds, Madison, Neshoba, and Yalabusha. In some of these counties the damages were slight; in others entire fields were denuded of leaves.

In Louisiana the cotton-caterpillars, after several ominous demonstrations in July, appeared in force in several counties during August. They nearly "finished" the crop in Tangipahoa, and reduced that of Marion to a half average. In Conçordia many fields were entirely stripped of foliage. Severe injuries were inflicted in Red River and Saint Landry, while insects in formidable numbers were reported in Cameron, Carroll, Union, Rapides, Avoyelles, Baton Rouge, and Caddo. In Baton Rouge they were very annoying to peach and grape growers. In Orleans County truck-farmers suffered from the ravages of the large black grasshopper, (*Romalia microptera*,) Fig. 7.

In Texas serious damages to the cotton crop are reported in Austin, Gonzales, Atascosa, Matagorda, Milam, and Blanco Counties by cotton-caterpillars, grasshoppers, and an undescribed insect. In Gonzales County grasshoppers also inflicted great injury upon bottom crops of corn.

The cotton-caterpillar and the boll-worm completed their summer's work by a very effective demonstration during September. North Carolina, judging from previous reports, had enjoyed almost entire immunity from this scourge during the summer, but during September it was felt seriously in several parts of the State. Reports of insect depredations have been received from Tyrrel, Wake, Craven, Edgecombe, and Sampson Counties. In Dooly County, Georgia, the caterpillars appeared early in the month, and entirely swept the top crop. They reduced the yield one-half in Calhoun County, and were very mischievous in Muscogee, Lee, Sumter, Worth, Columbia, Heard, Marion, Schley, Wilkinson, Chattahoochee, Upson, Liberty, Whitfield, Clay, and Decatur Counties. In several cases their depredations exceeded anything of the kind previously known, involving the destruction of leaves and bolls entire. In other cases their injuries resulted in the reduction of the yield by a very formidable percentage. Caterpillars and boll-worms also figure prominently in the Florida County reports. Serious depredations were committed in Liberty, Jackson, Suwannee, Orange, Gadsden, Jefferson, Alachua, Clay, Columbia, and Levy Counties. In Alabama, the same blighting influence was felt in Saint Clair, Hale, Butler, Clarke, Lee, Montgomery, Colbert, Blount, Calhoun, Macon, Chambers, Pike, Autauga, Perry, and Limestone Counties. In some cases, as in Pike County, the brunt of the disaster fell upon the lowland cotton. The mischief appears to have been even still more serious in several counties of Mississippi. In Jasper everything about the cotton-plant that a worm could eat was stripped. Complaints are very earnest of these depredations in Rankin, Warren, Grenada, Amite, Wayne, Yalabusha, Lauderdale, Washington, Wilkinson, Winston, Jefferson, Hinds, and Kemper Counties. In several of these counties very little cotton matured after August 1. Louisiana sends reports of insect dam-

ages to cotton in Union, Morehouse, Tangipahoa, East Feliciana, Concordia, Claiborne, and Washington Counties. Very great damage was also done in De Witt and Austin Counties, Texas. In the last-named county whole fields were swept.

The Colorado potato-beetle (*Doryphora decem-lineata*) made its appearance in Pennsylvania in two counties, in one of which the damage was reported as quite light. South of Mason and Dixon's line this insect is reported in one county in each of the States of Virginia, North Carolina, Alabama, and Tennessee, but in all these the injuries are reported small. The greatest annoyance is in the States north of the Ohio River. In Ohio several counties report greater or less injuries, not so severe, however, as those reported from Michigan. In Indiana this beetle was more or less destructive, while in several counties of Illinois it was despairingly pronounced a permanent scourge. In one county only (Outagamie, Wisconsin) were they pronounced worse than in 1871. In Minnesota and Iowa they were reported as disappearing in most of the counties, while in Kansas they were but incidentally mentioned. In Clarke County, Virginia, the *Cantharis* or common potato-beetle injured the crops to some extent. The counteracting agency of other insects destroying the Colorado beetle was mentioned with much satisfaction in different parts of the country. A correspondent in Erie County, Ohio, stated that the Colorado potato-beetle was quite numerous, this being their worst season, but by concert of action through the county it was kept in check; that when the weather was hot, the best way to destroy them was to keep the land well cultivated, and when the light, well-pulverized soil was hot, in the middle of the day, to knock them off the vines, and the heat of the ground soon kills them. When the weather will not admit of this, a tablespoonful of Paris-green in a pailful of water sprinkled on the vines will be effectual.

In several counties north of the Ohio River this insect was quite active. In some cases its depredations were serious, while in others they were successfully resisted by remedies. Infusions of Paris-green, dog-fennel, and May-weed were reported as quite effective in different places. The general opinion appears to be that these insects were not nearly so numerous or destructive as in former years. Similar reports come from Minnesota, Iowa, and Missouri. In Pulaski County, Missouri, the disappearance of the beetle is attributed to the destruction of its eggs by the lady-bug, (*Coccinella*,) which appeared in great numbers. In Nebraska the Colorado beetle was more annoying, its ravages being quite severe in several counties. In Boone County the "old black potato-bug, enlarged and improved," was quite a nuisance. This was, probably, the *Macrobasis albida*, specimens of which have been received by the Department, with the statement that they devour, not only potatoes, but several other vegetables. From the same locality come reports of a large round beetle, with faint stripes along its dusky back, which has been very destructive. The terms of description suit several destructive insects, and hence are insufficient to identify the one in question. In Republic County, Kansas, the "old-fashioned" potato-bug (*Cantharis cinerea*) greatly injured potatoes and beets. The Colorado beetle was also annoying in Helena County, Montana. In Iron County, Utah, potatoes, beets, and corn were destroyed, to a considerable extent, by a dark-green worm, an inch and a half in length, not yet identified. Our correspondent says that the ground was literally covered with these worms. It was reported in Madison County, Virginia; Logan, Tuscarawas, Ross, Pickaway, Morgan, Meigs, Coshocton, Butler, and Ashland Counties, Ohio; Washtenaw, Montcalm, Lenawee, Clinton, and Antrim

Counties, Michigan; Marion, Gibson, Decatur, Steuben, and Franklin Counties, Indiana; Winnebago, Putnam, Cass, and Clark Counties, Illinois; Outagamie, Wisconsin; Steele and Redwood Counties, Minnesota; and in Thayer County, Nebraska. In most of these cases the Colorado beetle (*Doryphora decem-lineata*) was mentioned specifically. In New London County, Connecticut, the white and wire worms were spoken of, and in Thayer County, Nebraska, blister-flies, as injurious to potatoes. Hardin County, Iowa, was exempt after seven years of visitation. "Tyck's Seedling" potato is reported there as "bug-proof."

The chinch-bug, (*Micropus* (*Rhyparochromus*) *leucopterus*) was especially destructive to sorghum in Adams County, Ohio; in Jennings and Brown Counties, Indiana; in Jasper and Phelps Counties, Missouri; and in Linn County, Kansas. The newly-sown wheat crop has felt their ravages in Brown and Jennings Counties, Indiana; in Macon, Boone, Polk, Crawford, Jasper, and Reynolds Counties, Missouri: and in Linn County, Kansas. Franklin County, Illinois, was overrun with them to the great damage of the corn crop, as also in Jennings and Boone Counties, Indiana; in Macon, Boone, Crawford, Polk, Jasper, Reynolds, Phelps, Miller, and Iron Counties, Missouri, and in Linn County, Kansas. In Crawford County, Missouri, three distinct broods are noted. The first appeared about the 1st of May, and inflicted such damage upon the wheat crop that several fields were plowed up. The second brood came about the last of June, and the third about the last of August. At the last visitation the corn was in milk, and upon it they fell with great voracity, very seriously reducing its yield both of grain and of fodder.

Chinch-bugs destroyed the sorghum crops in Brown County, Indiana, and Phelps County, Iowa; in the former the old Chinese sorghum is especially mentioned, the other varieties not being injured.

The Hessian fly (*Cecidomyia destructor*) was observed during October in the early-sown wheat of Botetourt County, Virginia. The young crop was here attacked also by some unknown insect working under ground and devouring the rootlets and stalks. During November this insect was observed in Frederick, Shenandoah, and Page Counties, Virginia; Clarke County, North Carolina; Fulton County, Arkansas; Berkeley County, West Virginia; Miami and Vinton Counties, Ohio; and Jennings and Saint Joseph Counties, Indiana. In the last-named county the ravages of this insect were confined to sandy soils. During the spring the fly infested the wheat in Ralls County, Missouri, and in Labette County, Kansas. In the latter-named county it was observed especially in early-sown crops.

West of the Missouri River grasshoppers (*Caloptenus spretus*) were quite destructive in some localities. In Ottawa County, Kansas, they appeared August 15, and for three days wrought havoc in the corn. They did great mischief, also, in Madison and L'eau-qui-court Counties, Nebraska. In Bonhomme County, Dakota, they appeared August 10, and remained two days, partially destroying the corn crops. In Morgan County, Utah, they were so numerous as to prevent the sowing of buckwheat. In Columbia County, Oregon, they made great havoc of grass and grain crops, scarcely leaving a trace of clover, and then attacked gardens and fruit-trees. Grasshoppers were numerous, but not destructive, in Milam County, Texas, and are reported in Rice County, Kansas. In Morgan County, Utah, they destroyed half the spring grain and a fourth of the potatoes. A grasshopper (probably *Caloptenus femur-rubrum*) in Lincoln County, Kentucky, cut the buckwheat down close to the ground. In Thayer County, Nebraska, corn was seriously damaged by *Caloptenus spretus*. In Franklin County, Kansas, all the experimental

crops of blue-grass were swept by grasshoppers. In Kendall and Blanco Counties, Texas, immense swarms of this destructive insect are reported as perforating the earth and laying eggs for their next generation. They afterward departed southward.

A cut-worm (*Agrotis?*) was destructive to corn in Oakland and Calhoun Counties, Michigan; Outagamie County, Wisconsin; and Franklin County, Missouri. This insect was especially troublesome in corn planted upon sod-land that had not been fall-plowed. Cut-worms were also reported in New England and the Middle States as destructive to corn, tobacco, meadows, and fruit. In North Carolina an insect, probably another variety of the cut-worm, is reported as injuring cotton. In Sullivan County, Tennessee, the worms were dug out of the ground, as many as sixty having been found in a single hill of corn. In Upshur County, West Virginia, and in several counties in Ohio, Michigan, and Indiana, the ravages of the cut-worm have been quite severe. This insect is occasionally mentioned in the reports from Illinois and Missouri.

Species of *Agrotis* were injurious to corn in Howard County, Maryland, and in Cass County, Michigan.

In Hamilton County, Indiana, and Lee County, Iowa, the hay-crop was destroyed, and in New London County, Connecticut, the grass, in many meadows, was eaten up at the roots by a worm which, most probably, was the *Lachnosterna fusca.* The white grub-worm—a name which popularly designates several species of the *Lachnosterna*—was more or less injurious to corn in Cass County, Michigan; in Noble and La Porte Counties, Indiana; and in Muscatine and Mahaska Counties, Iowa. The white grub was also destructive to sod-land corn in Washington County, Rhode Island. In a few other localities in Rhode Island and Connecticut our August returns indicated injuries to oats, sod-corn, and grass crops by the army-worm, (*Leucania unipuncta.*) The army-worm greatly damaged oats in Carroll and Ogle Counties, Illinois. In Cherokee and Labette Counties, Kansas, they did great mischief in newly-sown wheat, especially on stubble-ground. Ravages of insects bearing this name were reported in Pike and Posey Counties, Indiana, in White County, Illinois, in Jefferson County, Iowa, and in Nevada County, California.

Mr. Charles B. Thompson, of Elwood, New Jersey, writes to the Department that after having made many inquiries as to the means of extirpating the rose-bug, and tried many reputed remedies without success, he at length accomplished his object by the use of dry, unleached oak-ashes. He scattered the ashes upon the vines and the branches of peach and apple trees that were infested by the bug early in the morning, while the dew was on the leaves. The result was that within four days after this application the bugs had almost entirely disappeared. Mr. George Hardy, of Avola, Vernon County, Missouri, has made a similar experiment with the same favorable result. He writes to the Department that to prevent the bugs from injuring his vines he scattered oak-ashes (unleached) on them while the dew was on, and with such success that a second application was unnecessary.

The locust or *Cicada* made its regular seventeen-year visitation in Wise County, Virginia, especially injuring young fruit-orchards. Locusts were also annoying the peach-growers of Madison County, North Carolina. In Red River County, Louisiana, they injured young cotton-plants. In Richland County they appeared May 14 and departed June 12. They were present in immense numbers in Laurel County, Kentucky, from May 13 to June 20, but did no serious damage. They were more destruc-

tive, however, in Shelby, Jefferson, Jackson, and Pulaski Counties. They were reported also in Highland County, Ohio.

Mr. William R. Marine, of Green Castle, Missouri, writes to the Department that he has discovered a remedy for the ravages of insects or bugs upon plum-trees. He says: "I have been successful in the use of road-dust and sulphur. To one bushel of road-dust I add five pounds of sulphur, and commence the use of this mixture about the time the petals fall off, dashing in handfuls among the young plums, morning and evening, two or three times a week, for the space of six weeks, or until the plums have attained a sufficient growth for resistance to the operations of the bug."

The pea-bug (*Bruchus pisi*) troubled farmers in some parts of Davis County, Utah, causing them to discontinue the planting of peas.

In Mecklenburgh County, Virginia, tobacco-worms (*Macrosila Carolina*) were less destructive than usual; these grubs were destroyed by hornets and yellow-jackets.

Aphides or plant-lice have been found in the hops in Oneida County, New York. In Bladen, Moore, and Perquimans Counties, North Carolina, and in Marlborough County, South Carolina, this pest has been annoying to the cotton-planter.

Much harm was done by cabbage-worms in Luzerne County, Pennsylvania, and Cecil County, Maryland.

The canker-worm was destructive to apple trees in Middlesex County, Massachusetts.

Owing to the very imperfect description given, by some of our correspondents, of the insects sent to this Department for examination and identification, it is hoped that hereafter they will either describe them more fully, or, what is much better, send specimens of the insects themselves by mail, so that the entomologist may be able to identify them. Soft-bodied larvæ may be sent alive in small tin or wooden boxes, with some of the plants they feed upon inclosed; or if dead, they may be placed in vials of weak alcohol. All beetles, plant-bugs, and hard-bodied insects may also be placed in alcohol, though the bottle must be protected from breakage if sent through the mail. Butterflies, moths, &c., may be killed by a slight pinch on the thorax, and may then be sent folded in envelope corners or triangular slips of paper. Where there are a number of these papers they may be conveniently packed in tin or small wooden boxes. All packages should be addressed to the Commissioner of Agriculture.

It is also hoped that our correspondents will particularly mention what remedies are used in their neighborhood, and with what success, in destroying our most common noxious insects, such as the wheat-fly, Hessian fly, chinch-bug, army-worm, Colorado potato-beetle, &c. It would also be well for southern planters to make a specialty of reporting the success they have met with in applying remedies for the destruction of the cotton-worm or fly, and the boll-worm, or if any means whatever have been used in their neighborhood to destroy them, and what they recommend.

NOTES ON THE DIPTERA, WITH THEIR REMEDIES.

The following remedies, to guard against the injuries caused by the diptera, or two-winged flies, as well as for the destruction of the insects themselves, have been selected with great care from the works of our best entomological authorities, from reliable agricultural correspondents, and from experiments made in the Department. It will, however,

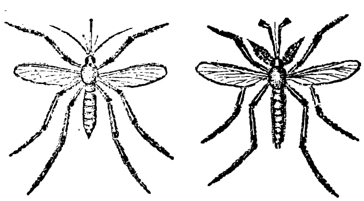
be necessary to commence with a short description of their transformations, natural history, and habits, so as to show at what period of their existence it is they do the most injury, and to enable us to decide as to whether it is in the egg, larva, pupa, or perfect state that the insect can the most readily be found and destroyed.

The order of *Diptera* includes such insects, or flies, as possess two wings only, and are provided with a proboscis or trunk for sucking alone, and not with mandibles, or jaws, for biting or masticating their food. This order is very important to farmers, as producing several of the most minute, but at the same time most formidable enemies which they have, as, from the extremely small size of the larvæ, and their habit of hiding or burrowing in the stems, leaves, or roots of plants, they escape observation until the injury has been accomplished.

The immense numbers, also, in which the flies appear all at once, enable them to spread almost simultaneously over his fields and lay their eggs in or on nearly every individual plant in it, before anything can be done to prevent them. The egg of the female fly being deposited in some suitable locality, in the course of a short time a larva or maggot is hatched from it, which is generally of a yellowish dirty-white, or greenish-gray color, with a soft, naked body, and having *no* legs. Some of these larvæ are provided with a distinct head, but many of them have no apparent head whatever, and that part is merely indicated by its position at the anterior part of the body. It is worthy of observation, also, that it is in this larva state that the *Diptera* do the most injury to vegetable products, by eating or boring into roots and stems, mining into leaves, seeds, and fruits, forming galls, &c. The larvæ of the grain-destroying *Diptera* are generally so minute, and hidden within the substances they attack, that they escape the observation of the farmer until the damage is done, and it is only by the sickly yellow appearance of his crop that the agriculturist is led to examine the plants in order to find out what is troubling him, and then, too late, he discovers the millions of almost invisible grubs which have totally ruined his hopes of a good harvest. When the larva of a dipterous insect is fully fed and ready to undergo its metamorphosis, it either sheds its skin and changes into a naked pupa, or, the skin of the larva shrinking and hardening, it assumes an oval form, and changes to a chestnut or brown color, and it is in this hardened skin of the former larva that the pupa is formed, which lies, for a shorter or longer period of time, perfectly motionless, and eats nothing whatever, until at last the perfect fly bursts out of one end of its pseudo cocoon, and flies off to perpetuate its species on the surrounding plants.

It is in the perfect or winged state only that many of the *Diptera* annoy mankind and cattle, by piercing the skin in order to suck the blood, as in the case of the horse or gad flies, the mosquito, and many others. In some of the other *Diptera*, however, the pupa is not quiescent, but is active and lively, as in the case of the mosquito, the pupa of which insect swims about in the water with great activity and restlessness.

Fig. 9.

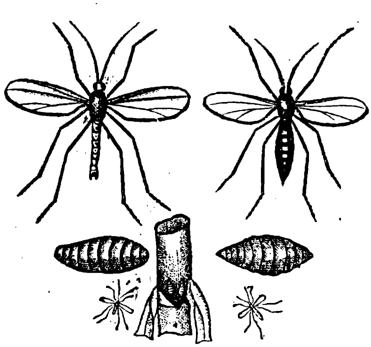


The larva of the common mosquito (Fig. 9) lives in stagnant water, and may be seen on any summer day swimming about, with a sort of wriggling motion, in small ponds or pools of water by the roadside, and especially in rain-water reservoirs or hogsheads placed under the spouts

of gutters, from the eaves of houses. Here they swarm in the form of young tadpoles or bull-heads, and our rain-water casks, unless tightly covered, serve as nurseries or breeding-places for the million of mosquitoes which annoy us so much in the evening and during the night. A single bucket or pitcher of rain-water carelessly left for a few days in a bedroom, will serve as a convenient and commodious breeding-pond for some thousands of mosquitoes. A little sweet oil poured on the water in a cask or reservoir will destroy these larvæ, as they have to come to the surface for the purpose of breathing, the oil closing up their organs of respiration. If the water be drawn from below the oil, by means of a siphon or spigot, the oil will still remain on the surface and not become mixed with the water so as to injure it for the purpose of washing, &c.; at the same time it is somewhat questionable if the water will not lose some of its good qualities for drinking purposes by being completely cut off from the action of the air. The larvæ of mosquitoes are said to be of some utility as forming food for young fishes, and as destroying minute confervæ and other substances which would otherwise generate in the water, and, by their decay, render it putrid and offensive. When "camping out" in the woods, a "smolder" of smoke from damp wood and leaves to windward will drive the insects away. Citron or lemon juice, ammonia or ether, and camphor, will allay the irritation caused by their bites, and burning camphor in a room is said to drive the insects away; and when unprotected by veils or mosquito-nets, a little of the oil of pennyroyal rubbed over the hands and face has been found useful in banishing them, and a sponge saturated with it, hung at the head of the bed, over the face of the sleeper, when unprotected by anything else, is said to be effectual in driving them off, as they endeavor to avoid this scent, which appears to be very offensive to them. Dilute carbolic acid and coal-oil or kerosene have been used in the same manner, but it is somewhat doubtful whether the smell of the coal-oil is not more offensive even than the bite of the mosquito to most persons, and in that case "the remedy" would be almost "worse than the disease."

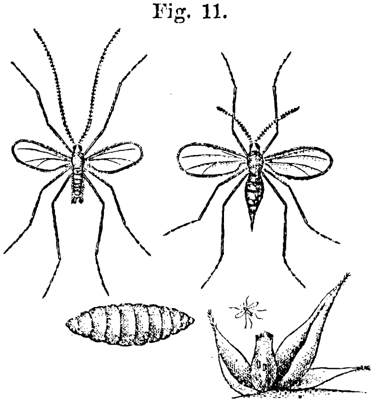
The eggs of the Hessian fly (*Cecidomyia destructor*) (Fig. 10) are deposited in longitudinal creases in the blade of the plant of wheat, barley, rye, &c., in autumn and spring. These eggs hatch in from four to twenty days, according to the state of the weather. The larvæ or grubs crawl down, working their way between the leaf and main stalk till they come to a joint, where they remain and suck the sap. They attain their full growth in from four to six weeks. The pupa is formed in the same place, its outer covering or puparium resembling a flax-seed. The winged insects appear in April and May, and lay their eggs in wheat and other cereals. Curtis says that feeding the wheat off with sheep in winter might possibly save the crop from the Hessian fly. Dr. Harris recommends the same as a partial remedy. Mr. Herrick states that the stouter varieties of wheat should be chosen, and the land kept in good condition. If fall wheat is sown late some eggs will be avoided, but the risk of winter-killing will be incurred. Great numbers of the pupæ may be destroyed by burning the stubble immediately after harvest, and then plowing and harrowing the

Fig. 10.



land. Steeping the grain and rolling it in plaster or lime tends to promote a vigorous growth, and is therefore beneficial. Quicklime strewed over the field immediately after the grain is cut would doubtless destroy many of the pupæ. Sowing the field with wood-ashes, two bushels to the acre, in autumn, and then again the first and last weeks in April, and as late in May as the field can be passed over without injury, has been found useful; and it is recommended that fresh seed be procured from localities not infested by the insect. There are several parasitic hymenopterous insects in Europe which destroy this insect, viz, *Chalcis*, *Macroglenes*, *Platygaster* (*Inostemma*) *semiotellus*, (or *Ceraphron*,) &c., and which serve very materially to diminish the number of these insect pests, and which might probably be introduced with benefit. The larvæ of the wheat-midge, (*Diplosis* (*Cecidomyia*) *destructor*,) (Fig. 11,) in the Western States are frequently miscalled the weevil or red weevil, from the color of the maggots. They are very destructive to wheat, barley, rye, grass, &c. The eggs are deposited in June and July, in the opening flowers of the grain. These hatch in about eight days, and produce minute, orange-colored grubs, which feed upon the juices of the grain when in a milky state, inside the chaff or outer covering, or upon the pollen of the flower. When fully grown most of the larvæ descend and burrow in the earth, where they remain all winter. The pupæ usually are formed in the ground in May or June; some, however, remain in the heads, and the perfect fly or midge makes its appearance the following season to deposit its eggs on the grain and grass. Dr. Fitch says that late sowing is one of the most easy and successful expedients to avoid the injury caused by them. Dr. Harris states that fumigation, by burning strips of woolen cloth dipped in melted brimstone, to the windward side of the field, at the time the grain is in bloom, proves very offensive to the flies when depositing their eggs. Some farmers, however, who have made a trial of it, say that the remedy is of no practical benefit. Lime or ashes, strewn over the grain when in blossom and wet with dew, will be useful. Newly-slaked lime and wood-ashes will be required, in the proportion of a peck to a bushel to the acre. When the maggots have left the grain and are in the ground, plowing is recommended as soon as the grain is harvested. Perhaps thoroughly liming the soil before plowing might aid in the destruction of these insects. A sieve may be used in winnowing to separate the chaff from the pupæ and dust, which should be destroyed; or the chaff and refuse-straw together, containing the larvæ or pupæ, should be scalded, burnt, or otherwise destroyed. Early sowing of all wheat in the autumn, or late sowing of spring wheat in the spring, will enable the wheat to become too far advanced, and hard, before the fly makes its appearance in the first case, and by not coming into blossom in the last, until the flies have disappeared. When the midge has been very abundant the previous summer, deep fall plowing has been recommended, and a different crop should be put on the next season.

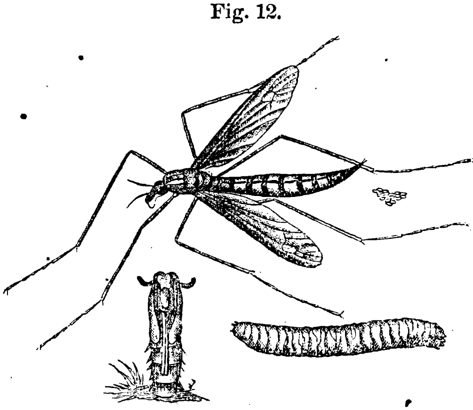
Fig. 11.



In Massachusetts, wheat sown after the 15th or 20th of May generally escapes the ravages of the midge. Dr. Fitch states that in 1854 this

insect caused a loss in the State of New York of $15,000,000. It has been suggested not to sow wheat at all, for some time, wherever the insect has been plentiful; but Dr. Fitch thinks it is of no use to try to starve the midge out by depriving it of wheat for a year or two, as it would probably feed upon grasses, and return to its favorite food when wheat was cultivated again. He likewise says that the flies or midge do not thrive in a warm, dry atmosphere, and that hence we learn that if the last half of June is unusually dry, the wheat escapes, but if wet and showery it is likely to suffer from the midge. Burning the stubble, as in the case of the Hessian fly, is said not to affect this insect, as the larva burrows beneath the earth to change into the pupa, but lime or ashes plowed into the soil might be of utility. These insects multiply with great rapidity, and it is said that as yet no parasite has been discovered in this country to destroy or keep them in check, while several exist in Europe, and many of our best entomologists have recommended that these European parasites should be imported, at any expense, in order to destroy the wheat-midge here. Boards smeared with some adhesive substance have been recommended, and might no doubt catch many of the flies, but would be almost useless in any large fields; bonfires at night, also recommended, would doubtless attract numbers of these insects and lure them to their destruction, especially if they were disturbed by drawing a light cord over the heads of the grain at the time the fires were burning. But until we find some parasitic fly, like the European species, to aid us in their destruction, there is very little hope of successfully battling with this little pest. In this country a species of thrips (*Orthoptera*) is said to destroy the eggs or larvæ; a coccinella or lady-bird (*Coleoptera*) feeds upon the larvæ, and the yellow-bird (*Carduelis tristis*) is said to feed upon them. In Europe they are destroyed by several parasitic hymenoptera, viz, *Callimone*, *Macroglenes*, *Platygaster*, &c. The earwig also destroys either the wheat-midge or a thrips which frequents the wheat. The gooseberry-midge (*Cecidomyia* (*Asphondilia*) *grossulariæ*) injures gooseberries by depositing its egg in the fruit, and the larva, or grub, being hatched, feeds inside, and causes the gooseberry to present a prematurely ripe appearance, to turn red, and then to drop from the bush. It is recommended to pick all fallen fruit from the ground and burn it immediately, as, although this proceeding may not be of any use the same season, the berries being already destroyed, the following year the horticulturist will experience the benefit of having done so, as, the last season's generation being destroyed, there will be scarcely any midges to attack his future crops. When galls are formed by the larvæ of *Cecidomyia* or *Lasioptera* upon trees or plants on lawns, or planted out for ornamental purposes, they can be materially diminished by cutting off and burning the part affected, as early as possible in spring, so as to destroy the late generations; this is especially the case with the curled leaves of the locust, which are caused by the locust-gall gnat, (*Cecidomyia robiniæ.*)

Fig. 12.



The larvæ of the crane-fly or daddy-long-legs reside in the earth, and in Europe are very injurious by eating the roots of grass, grain, vegetables, and flowers, and *Tipula oleracea*, (Fig. 12,) *maculosa*, &c., are most especially complained about as doing a great deal of injury in gardens and fields. These insects are infested with a parasitic mite, *Ocypete rubra*. Some of the *Tipulariæ* are of a large size, and all have two wings, and are remarkable for the extreme length and slenderness of their legs. They must not, however, be confounded with what is here commonly called daddy-long-legs, which is a spider (*Phalangium*,) and has eight instead of six legs, possesses no wings, and feeds upon other insects. Curtis states that rolling the ground with clod-crushers will destroy the larvæ, pupæ, and perfect flies of the *Tipula*, as the latter is somewhat sluggish in its movements, especially early on cold mornings, when the dew is on the grass. Hand-picking is recommended for gardens and small inclosures, and soot, salt, and sea-sand sown on the surface will prevent their increase. Paring and burning the turf is recommended where they are especially numerous and injurious, in pastures and meadow-land; and watering the ground with salt or nitrate of soda is said to be efficacious in destroying the larvæ. Some of the crane-flies appear to prefer low, damp meadows, and in such cases draining is said to be useful. In this country, however, we do not appear to suffer so much from these insects as in England, where the climate is more moist, and the frost in winter is not so severe as with us, and probably, also, our hot, dry summers are not so favorable for their increase.

Turnips in England are frequently affected by a disease in which the roots become knotted and gnarled; this is called Anbury (Fig. 13,) and was at one time attributed to the attacks of a small turnip-gnat, (*Trichocera hyemalis*,) (Fig. 14,) which appears on warm days in winter, in multitudes, as it were, dancing in the air in the sunshine. This gnat, however, has been found not to be the cause, but merely the effect of the disease, as the semi-putrid and unhealthy roots present a proper locality for the insect on which to deposit her eggs, and the larvæ, of course, find a suitable food in the diseased roots. Should this disease affect our turnip crops, Curtis says that marl or chalk is a certain cure for it.

Fig. 13.

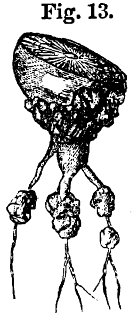
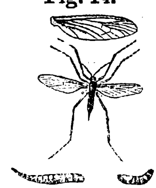


Fig. 14.



The *Simulidæ* are very small, bluish and gray gnats, and are generally known as sand-flies or midges; they are exceedingly annoying to mankind and animals by their painful bites, which feel as if a spark of fire had dropped on the naked skin. The larvæ live in the water, and have been accused of destroying very young trout, by spinning their web among the ovæ in the water of breeding-ponds. The remedies used to prevent the attacks of the flies are the same as those recommended for mosquitoes, viz: veils, nets, and anointing the hands and face with essence of pennyroyal, &c. (See mosquito and *Culex*, p. 127.) One species (*Simulium columbaschensis*) is extremely numerous in Hungary, in certain seasons, and actually kills cattle, horses, &c. To prevent the attacks of these insects, Köller recommends two pounds of tobacco-leaves, first boiled in twenty pounds of water down to one-half, then strained and again boiled to the consistence of honey; this preparation is then mixed with one pound of old lard, and half an ounce, at least, of petroleum oil, and makes a very efficacious salve. Perhaps a wash of

diluted carbolic acid might prove equally efficacious in driving them away.

The females of the *Tabanidae*, horse or gad flies, are exceedingly troublesome by attacking and biting horses and cattle, especially in woody districts. A large black species, (*T. atratus*,) (Fig. 15) is especially troublesome in Maryland, from its great size, and the severity of its bite or sting. A smaller species, (*Chrysops*,) known as the golden-eyed forest-fly, (Fig. 16,) from the beauty and metallic luster of its eyes when alive, and in the Western States as the ear-fly, from its habit of attacking generally the ears of the horses, is very annoying. It is, however, stated that if the horse be washed with a strong decoction of walnut-leaves, or smart-weed, before commencing a journey, it will not be attacked by the gad flies, as they avoid the odor or taste. Lobelia, aloes, and quassia are sometimes added. Petroleum oil, or very dilute carbolic acid would most probably have the same effect.

Fig. 15.

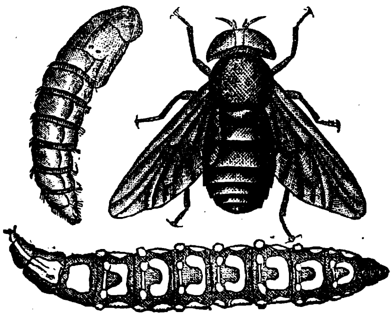


Fig. 16.

Sheep are sometimes severely injured by the larva of a fly known as the sheep-bot, or head-maggot, *Œstrus* (*Cephalomyia*) *ovis*. The egg of the fly is deposited in the nostrils of the sheep the maggots make their way up the nostrils into the head, where they live in the maxillary and frontal sinuses. When ready to change, they descend, or are sneezed out, fall to the ground, and change to pupæ in the shortened and hardened skin of the larvæ, which forms a sort of cocoon for them, and the perfect fly appears in a few weeks. Köller states that formerly they were taken out of the head by trepanning, but that process must be extremely dangerous. Injections and the smoke of burnt leather have been recommended; smearing the noses of sheep with tar is also highly spoken of as preventing the fly from laying her eggs in the nostrils, and Professor Verrill says that "the sheep may be made to do it themselves by boring large auger-holes in logs, to contain salt, and frequently smearing the adjacent wood with tar." "When the grubs are in the nostrils they may be removed to a considerable extent by a feather wet with the oil of turpentine, camphor, or a weak solution of carbolic acid or creosote. Lime in fine powder is sometimes used, as by sniffing it the sheep sneeze and thus expel the larvæ. Salt water or dilute carbolic acid may be injected into the nose with a syringe." It is also advisable that sheep should not be placed in pastures where other sheep have already been that were troubled with the head-maggot, or sheep-bot fly, as the larvæ remain in or on the ground from six to ten weeks, and after that time a fresh supply of flies will make their appearance to annoy the flock.

Fig 17.

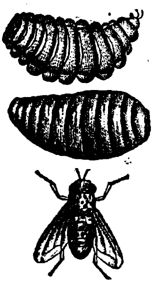
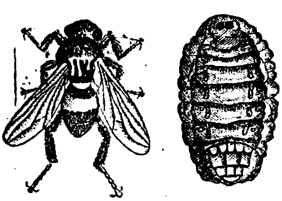


Fig. 18.



Cattle are frequently annoyed and injured by a skin-bot fly, (*Hypoderma* (*Œstrus*) *bovis*,) (Fig. 18,) the larvæ of which reside in large open tumors or abscesses under the skin, on the backs of oxen, cows, &c. These in England are known by the local name of wormals, (probably derived from the words "worm-holes,") and the larvæ subsist on the purulent matter produced by the constant irritation caused by the grub. The larvæ remain all winter in these tumors, and when fully developed the following season they squeeze themselves through the aperture in the skin, purposely kept open by the larva, fall to the ground, change to pupæ in the shrunken, oval, and hardened brown skin of the larva, and appear, from the month of June to September, as perfect flies, which again lay their eggs in or on the backs of cattle. A very simple and safe remedy for the skin-bots is to enlarge the opening of the tumor with a knife and press the sides of the swelling until the larva is squeezed out, taking care, however, not to burst the skin of the grub. The wound then heals without any further remedy, if it is only kept clean.

The stomach-bot fly of the horse (*Gasterophilus* (*Gastrus*) *equi*,) (Fab.) is very troublesome to horses when kept in open pastures. The larvæ live in the stomach and are commonly known as "bots." The eggs are deposited by the female on the hair of the horse, commonly on the knees and shoulders, and after being bitten or licked off by the animal, hatch almost immediately when in the mouth, by the heat and moisture, and are swallowed with the food. When once in the stomach the young bots or grubs fasten themselves, by means of hooks at the anterior portion of the body, to the coating of the stomach, frequently forming clusters. When fully grown these bots let go their hold upon the stomach, and are voided with the excrements and fall to the earth, in which they bury themselves. The skin of the larva then shrinking and hardening, an oval brown case is formed, in which is formed the pupæ, and after forty or fifty days they emerge through a hole burst through the puparium or cocoon-like case, in the form of bee-like two-winged flies, which again deposit their eggs on horses. Professor Verrill, in his interesting and able report, says "the bot-worms have been accused of perforating the walls of the stomach, and this may possibly be the case in very rare instances, but the perforations of the stomach so often found in *post-mortem* examinations are generally caused by the digestive action of the gastric juice *after* the death of the animal." Dr. Harris states that "no sure and safe remedy has yet been found for removing bots from the stomach." Köller recommends animal oils, but Mr. Bracy Clark doubts the beneficial results, as oils which might seem efficacious, by closing the spiracles or breathing-pores of the bot, and thus destroy it, are soon reduced to soap and digested so as to be scarcely of any avail; and, as prevention is better than cure, he suggests an effectual mode of preventing the introduction of the bots into the stomach, by washing off the eggs (which on dark horses are very conspicuous, from their lighter color,) as soon as observed, from the knees, mane, and shoulders of the horse, or by removing them with a pair of scissors. It is believed by many farmers that molasses and milk taken by the horse will cause the bot to let loose its hold on the coating of the stomach to feed upon the sweet mixture, and a powerful purgative being given soon afterward the horse will eject the bot before it has had time to refasten itself to the stomach. Bleeding the horse in the mouth or nose, and causing him to swallow the blood, is said by some to have the same effect. Entrails of chickens and pieces of raw flesh have also been used, but we have no faith in such remedies, and they are merely mentioned as having been used. Some farmers recommend the use of salt or brine in the horse's

food once a week. Professor Verrill says "a wash of carbolic-acid soap has been recommended to destroy the eggs on the hairs of the horse, and that oil or spirits of turpentine is a remedy in common use, but should be used with caution, if at all. Cases of drugs being used, where the larvæ are thereby voided, it is possible that those already in the intestines are the only ones affected."

Dr. Porcher, in his work on the resources of the South, when speaking of the Pride of India, or China tree, (*Melia azederach*,) says that trees are "planted around stables in order that the horses by eating the berries might be prevented from having bots." He then adds that "the leaves and berries packed with dried fruit will preserve them from insects, and will also prevent moths in clothes;" he likewise recommends a solution or decoction made with the berries, (half a bushel of the berries and fifteen gallons of water,) soaked one or two days, sprinkled with a watering-pot over the plants. This, he states, will in most cases prevent the depredations of the black grub, or cut-worm, and that planted in peach-orchards it is said to prevent the attacks of insects. If these berries and leaves have proved so useful in the southern states in destroying insects or preventing their depredations, would it not be well to institute a series of experiments to test their real value as an insecticide?

The family (*Tachinidæ*) are almost all beneficial, as their larvæ destroy the caterpillars of noxious moths and other insects. House-flies, being bred in filth and manure, may be prevented from multiplying about houses by keeping the premises clean, and by frequently sprinkling quick-lime wherever they are likely to breed. Stables, hog-pens, and hen-houses should be placed as far as possible from the dwelling. A mixture of quassia and water boiled together, then strained and sweetened with sirup or molasses, benumbs the flies, and strong green tea, well seasoned, is said by Harris to poison them. Fly-stone (gray powdered crude arsenic) mixed with sugar and water, or sirup, is deadly poison to flies, and, unfortunately, to mankind also.

The so-called fly-paper is nothing more than blotting-paper soaked in some similar mixture, and then dried. When used for poisoning flies, it is to be placed in a saucer, and a small quantity of water poured upon it. This remedy, however, should never be used when the dying flies are apt to fall into food or drinking-utensils; and, as it is a deadly poison, care should also be taken not to use it in farm-houses, for if the dead flies are swept or thrown out into the yard, the young chickens will be very apt to eat them, and thereby be poisoned. Paper smeared with some viscid sweet substance, to which they will adhere, is also recommended, and in Europe is frequently used to entrap flies.

Chloride of lime scattered around the house, in the drains, and outhouses, is said to kill the larvæ, and prevent flies from multiplying, and at the same time it acts as a disinfectant and deodorizer. In low rooms in country houses, flies may be destroyed at night by thousands as they congregate on the ceiling, by merely filling a tumbler half full of frothy soap-suds, and suddenly placing it directly under and over them; on attempting to fly, they are caught in the frothy liquid, and when the tumbler is filled they can be emptied out and destroyed. When flies are very troublesome in shop-windows, a little Persian insect-powder, strewed daily over the lower portion of the wood-work of the window-frames, will destroy multitudes, as these insects almost invariably rest upon the frame before or after attempting to climb up the glass.

There is a plant growing in the Southern States, which is mentioned by Dr. Porcher as "fly-poison," or "fall poison," (*Amianthium muscæ-*

toxicum,) which is said to be a narcotic poison, employed by some families to destroy the common house-fly. The bulbs are triturated and mixed with molasses, but the flies, if not swept into the fire or otherwise destroyed, revive in the course of twenty-four hours. "Its foliage also poisons cattle which feed upon it in the autumn." There is a fungus found in Europe, (*Aminita muscarius*,) which, when infused in milk, is a deadly poison to flies, and is frequently used for that purpose. This fungus also possesses some very peculiar intoxicating properties, and is used as a stimulant by several of the northern nations. House-flies are destroyed by several parasites, among which are some hymenopterous insects, *Bembex*, *Vespa*, &c., (wasps,) which eat and carry them off as food for their young. A species of Chalcis also lives in their bodies. A red mite infests them externally, and numbers are destroyed by a parasitic fungus, *Empusa* (*Sporendonema*) *muscæ*, which grows in their bodies, and eventually kills them, leaving the dead fly adhering to the substance on which it died, and surrounded by a ring of a dusty white powder, which consists of spores of the fungus.

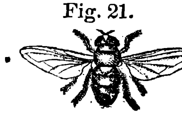
The common house-fly, and some other insects, are said sometimes to be dangerous to mankind by conveying infectious diseases from house to house, and several cases have been reported where the bite of an apparently common fly had caused dangerous festering sores. In such cases, however, it was presumed that the fly had previously been feeding on decaying carrion, and had inoculated the wound with putrid virus. There is a small fly, (*Stomoxys calcitrans*,) (Fig. 19,) resembling in general appearance the common house-fly, which stings mankind, horses, and cattle very severely. They are sometimes very abundant, especially before rain in dwelling-houses, and more especially when in the vicinity of stables. The same remedies recommended for the horse-flies (*Tabanus chrysops*, &c.) will apply to these also, and it is stated that horses may be protected from their attacks by rubbing or washing the animals with a strong decoction of tobacco-leaves, of smart-weed, (*Polygonum hydropiper*,) or the leaves of the English walnut, and doubtless a weak solution of carbolic acid would answer the same purpose.

Fig. 19.

The insects of *Sarcophaga carnaria* and other flesh-flies are frequently very troublesome by depositing their larvæ or eggs in open wounds or festering sores, in man and beast. The remedy is to wash frequently with a weak solution of carbolic acid, to keep the wound clean, and, if possible, to protect it with some slight covering, so as to prevent the flies from settling on it. The larvæ or grubs of *Calliphora vomitoria*, (Fig. 20,) *Lucilia cæsar*, (Fig. 21,) and other so-called blow or meat flies, have been used with great success as food for young pheasants in this country, and no doubt would form a healthy article of food for young turkeys and chickens. When wanted for this purpose, a piece of lights or liver, or a sheep's head, is hung up in some place away from the dwelling, where it is exposed to the flies, but at the same time protected from the attacks of predaceous animals or birds. The meat-flies in the neighborhood will soon discover it, lay their eggs upon it, and in a few days it will be full of these voracious maggots. A large box filled with bran is then placed directly underneath, and in the course of a few days

Fig. 20.

Fig. 21.



the grubs, having attained their full size, drop into the box, and bury and cleanse themselves in the bran. When wanted, the box is taken away and a fresh box substituted. It is, however, necessary that the maggots should remain a day or two in the bran to cleanse themselves before being fed to the young golden or silver pheasants, as, if fed directly they fall from the meat, they appear to act as a putrid poison, and cause the death of the young birds. This cleansing or scouring process should be attended to most carefully, as a friend who takes great interest in raising golden and silver pheasants one season lost almost all his young brood by feeding them but one day on uncleansed maggots. This food likewise would be very healthy for mocking-birds, and also form a good bait for certain kinds of fish, and is well known to all rod-and-line fishermen in England by the name of gentles. Housekeepers using the ordinary wire-net covers to protect meats are often astonished at finding living maggots in it notwithstanding all their care, but it has been asserted that these blow-flies, being unable to get at the meat itself, do the next best thing, and that is, to get directly over it, and drop the eggs through the gauze-wire on to the meat below, where they hatch and produce the maggots; in such cases the top should be covered so as to prevent the flies from setting directly above.

The larvæ of a small fly, (*Anthomyia ceparum*,) or the onion-fly, (Fig. 22,) somewhat resembling a miniature house-fly, are very destructive to the onion crop in the Eastern States. The eggs of this fly are laid on the leaves close to the earth, and the larvæ destroy the root, and cause the plant to turn yellow, wither, and die. The larva state lasts about two weeks, the pupa is formed in the bulb itself, or in the earth near it, and the fly appears in two or three weeks afterward, and it is stated that there are sometimes as many as three generations in one season. The insect was imported about forty years ago. A dressing of sand and spirits of tar is said to be effective in preventing the ravages of *Psila rosæ*, (Fig. 23,) a small fly of somewhat similar habits, which attacks carrots, &c., in Europe, and might be used, perhaps, with advantage with our onion-flies, or petroleum, coal-tar, or oil might probably be used with sand in a similar manner. In order to create a bad smell to drive away this insect and similar flies injuring onions, carrots, turnips, radishes, &c., it has been recommended to water near the plants with a mixture of one gallon of soap-suds to four quarts of gas-water, or two quarts of tar. This is said to keep the flies away from the plants, so that they do not deposit their eggs on them; but it is doubtful, unless it is constantly renewed, especially after rains, and even then might injure the young plants if it came in contact with them. Dr. Harris suggests sowing the seed on ground where a quantity of straw has been burned. Tar and water, wood-ashes, lime, powdered charcoal, flour of sulphur, lime-water and soot, &c., &c., have all been highly spoken of as remedies. Mr. Sanborn recommends petroleum sprinkled along the rows, and watering with soap-suds, soot, or pyroligneous acid. Curtis recommends lime and salt to destroy the maggots; boiling hot water poured over the root is highly recommended by many, and is said to destroy the maggot without injuring the plants. The eggs of this fly are said to be destroyed by the larva of a *Chrysopa*, (a neuropterous insect.)

Fig. 22.

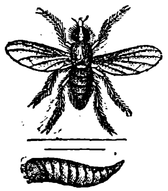
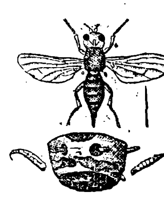


Fig. 23.



For another species of onion-fly, *Ortalis flexa*, found in the Western

States, it is said that a pound of copperas dissolved in a pail-full of soft-soap, when thinned with water, and applied to the onions, is good to keep off the maggots, and also to promote the growth of the plant. A preventive is suggested in Mr. Packard's last report, (1872,) which is to sow the seeds deeper than usual, so that the fly cannot so readily get at it to lay its eggs; it is, however, especially recommended that all yellow or diseased onions (or other bulbs and roots) should be at once removed from the beds, with as much of the roots and fibers as possible, and burnt or otherwise destroyed immediately. For other insects injuring roots, such as *Psila rosæ*, the small fly injuring carrots in Europe, *Anthomyia raphani*, and *radicum*, which injures radishes, &c., many of the same remedies as have been recommended for *A. ceparum* will answer.

Fig. 24.

The larvæ of some of the *Ortalidæ* feed in the fruit, stems, and leaves. The larva of one species, *Ortalis flexa*, (Fig. 24,) is injurious to the onion in the Western States; the remedies for this insect, however, will be found under the head of *Anthomyia ceparum*.

The *Trypetidæ* are small flies with mottled, marbled, or variegated wings; some of their larvæ feed in fruit, others are leaf-miners, while others form galls on plants; they, however, as yet, have done very little harm, and are merely mentioned as they are common on flowers in summer.

The larvæ of several species of small flies, *Chlorops*, *Ocinis*, &c., in Europe are very destructive to all kinds of grain, wheat, barley, rye, &c. One species alone, *C. frit*, is said to have caused a loss of $100,000 in one year in Northern Europe to the barley crop. The larvæ of this species live in the grain, and cause it to shrivel. Another of these larvæ injures grain by destroying the central shoot, and still a third, *C. tæniopus*, does great damage to wheat and barley by destroying the plant, and causing a peculiar swelling at the joint, popularly known by the name gout. It is somewhat singular that we hear no particular or decided complaints from our own farmers of any insects in the stalk of wheat, excepting the well-known joint-worm, which is a hymenopterous insect, and has four wings instead of two. We have several species of *Chlorops* in this country, the flies of which are extremely abundant among the plants in grain-fields, and, no doubt, do attack our grain in the same manner as the European species, but as yet they have not done damage sufficient to attract the attention of the agriculturist. In Europe, where these insects do much damage, the remedy is to change the crops to others which do not attract the fly, and it has been suggested that perhaps the parent flies themselves might be decoyed to their own destruction by some poisoned liquid; and, although one authority states that plowing and harrowing are of use, as the pupæ are formed under the earth, yet it appears plausible that a good rolling, plowing, and harrowing would so disturb the pupæ and throw many of them to the surface, where they would perish from exposure, and, at the same time, bury the rest so deep under the earth that, even if they completed their transformations, they could not struggle through the superincumbent earth, to appear as flies the next season. In Europe *Chlorops tæniopus* is destroyed by a parasitic four-winged fly, *Cœlinus niger*.

The larvæ of the *Agromyzidæ* are generally leaf-miners. One species, *A. tritici*, of Fitch, is accused of injuring wheat by sucking the grains when immature, and causing them to shrink in a similar manner to those injured by *Diplosis tritici*, or the common wheat-midge; and the same remedies will answer for both insects. It is, however, destroyed

by a small parasitic hymenopterous insect, *Diapria agromyzæ*, which prevents its multiplying to any great extent. The *Phytomyzidæ*, being leaf-miners, produce the blister-like spots and winding passages which may be so plentifully found deforming the leaves of our culinary vegetables and our shrubs and trees. They can readily be destroyed when they first make their appearance, by pinching the part affected between the thumb and finger, and thus killing the maggot within. Where there are a multitude of these leaf-miners at work, a top-dressing of gas-lime, wood-ashes, or soot and lime, might be useful in destroying such maggots as fall to the ground to bury themselves in the earth, or undergo their metamorphoses on the surface.

The *Hippoboscidæ*, or louse-flies, are flat, leathery insects, some of them (*Hippobosca*, &c.) having wings, while others (*Melophagus*) are apterous. They live among the hairs of animals, or the feathers of birds. The females of these insects do not lay eggs like the other flies, but produce their young only one or two at a time, and are born alive as larvæ, ready to assume the pupa state. *Hippobosca equina* (Fig. 25) in Europe is exceedingly troublesome to horses and cattle; they possess two wings, and from their flat shape, and the peculiar formation of their legs, they are able to crawl backward or sideways among the hair or feathers of the animals or birds they infest. They may be destroyed or driven away by spirits of turpentine or by washing with a decoction of tobacco. *Melophagus ovinus*, (Fig. 26,) or the sheep-tick, is a small louse-fly, without wings, that lives among the wool of sheep, and, in Europe, is very troublesome. They may be destroyed by dipping the sheep (with the exception of the face and head) in a mixture of arsenic, soft-soap, potash, and water, or other arsenical preparations; but they, being highly poisonous, are very unsafe remedies, and cannot be recommended for general use. Decoctions of tobacco, applications of brimstone, lard, paraffine oil, &c., about the neck, have been highly spoken of by some farmers. Professor Verrill says that "snuff or sulphur in powder, rubbed thoroughly into the wool, is sometimes used with good results, and a bath made by steeping tobacco in water, about 2 pounds to 10 gallons of water, in which the lambs are immersed, (except the face,) is said to be effective, but in some cases has proved injurious to the health of the lambs; probably the same solutions as used for the fleas would be equally effective for these, but the strength of the liquid should be adapted to the age, &c., of the animal to which it is applied."

Fig. 25.

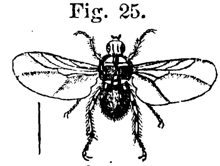


Fig. 26.

Fleas, although not mentioned by Loew or Ostensacken among the diptera, by many other entomologists are classed with them, and Professor Verrill regards them as "degraded diptera, in which the wings are represented only by two pairs of stiff scales, which have little or no power of motion." These insects are very abundant in the neighborhood of hog-sties, &c., and may be driven away by scattering quicklime about their haunts. The principal remedy against them is cleanliness, and should the house dogs be permitted to sleep on the door-mats or rugs, these should be scalded every week or two to destroy the living inmates as well as their eggs and larvæ, which are in the form of small footless white maggots, and live upon decaying vegetable and animal matter found in the dirt and rubbish. When dogs are kept in kennels,

the straw or shavings upon which they sleep should be carefully burned every few weeks, as door-mats and old refuse straw are perfect nurseries for these insects. When the animals themselves are very much infested with fleas, a thorough washing in strong soap-suds or a decoction of tobacco will drive many of them away. Professor Verrill says, "to remove fleas from the animals themselves, a wash containing 6 to 10 per cent. of petroleum, naphtha, or benzine, well shaken together, may be used; a weak solution of carbolic acid, about two or three parts to one hundred parts of water, will also be efficacious." A mixture of ten parts benzine, five parts soap, and eighty-five parts water has been recommended. Great care should, however, be taken not to make any of these mixtures too strong, as otherwise they are very apt to injure the animals to which they are applied. Camomile flowers are said to be very obnoxious to fleas, and to drive them away. Persian insect-powder, which is the powdered flowers of *Pyrethrum roseum*, or caucasicum, rubbed in among the hair, will drive off the fleas, but the animals, when operated upon with it, should be taken out of doors, as a small portion of this powder paralyzes the fleas only, and if they fall on the carpet they are apt to revive in a few hours. The animal, after an application of the Persian powder, should be well washed with soap and water. The flowers of feverfew, camomile, and even of ox-eye daisy have a somewhat similar effect, but much slighter, and when applied to common house-flies appear partially to paralyze them.

The jigger, or chigoe, *Sarcopsylla penetrans*, in the extreme South, is exceedingly troublesome, especially in the West Indies and South America. This insect is a small species of flea, which gently insinuates itself into the foot of mankind, &c., under the flesh, and generally under a toe-nail. In doing so it gives no pain, but the victim feels only a kind of itching sensation. When once settled, it buries itself in the flesh, where it remains, and, if not removed in time, deposits its eggs, the young from which burrow still deeper and cause most dangerous sores. In the West Indies they are easily taken out by old negro women who understand their habits, and are able to extract the whole insect with a needle without rupturing the abdomen, which is greatly swollen and distended, and appears like a small bag filled with eggs. Should the bag or abdomen burst, and the eggs remain in the wound, they must be cleansed out immediately, and some substance put in the wound that will destroy the eggs or young, when hatched out. One chigoe that we brought from Venezuela in the toe, did not develop itself perfectly until two or three weeks afterward in New Orleans, when, having no old negress to cut it out, the swelling was carefully cut open with a penknife and the insect extracted piecemeal, and the wound or hole filled up with hot cigar-ashes. This remedy certainly was somewhat painful, but it was perfectly effectual, as no young ever made their appearance, although the body of the parent had been burst open and some of the eggs no doubt remained in the wound. If in a neighborhood infested with these insects, a little spirits of turpentine poured in the boots is said by the negroes to have the effect of driving them away.

As before stated, it is of the utmost consequence for the practical entomologist and farmer to study in the field or from living specimens the habits, transformations, and instincts of the various insects he wishes to destroy, so as to find out exactly at what season of the year they make their first appearance, how and where they pass the winter, whether as egg, larva, pupa, or perfect insect; what weeds or wild plants they frequent, so as to extirpate them if necessary; what sub-

stances they are particularly fond of, or what they avoid, and at what stage of their transformations they may be most readily found and destroyed; if the larvæ infest stagnant water, let such pools be drained and afterward sprinkled with fresh lime; if they breed in the weeds or grass in the angles of rail fences, the weeds should be cut and burned when dry; if they hybernate under bark of dead stumps, let all such stumps be burned out before planting, for it must be observed that old rail fences, stone walls, and decayed stumps are the very best nurseries for noxious insects that could be invented, and any farmer may convince himself of the fact by merely pulling off dead loose bark or looking in the crevices of his loosely-built stone walls, protected, as they generally are, by a tall growth of weeds on each side, and he will find them swarming with noxious insects and larvæ, which, securely protected from the winter's frost and cold, hybernate in peace and quietness until the warmth of spring thaws them out, and induces them to leave their comfortable quarters in order to deposit their eggs for the coming season.

Quick-lime plowed into the earth will free the soil from many larvæ, especially such as perform their metamorphoses under the soil, and, when an insect has become so numerous as to endanger certain crops, it would be advisable to discontinue planting such crops in the infested neighborhood until the insect is, as it were, starved out, unless it is found, from experience, that the insect, in such a case, can subsist upon other plants, weeds, or grasses, until the same crop is again grown. Quassia, aloes, larkspur, or stavesacre seed, china berries, and leaves, are all useful in destroying certain insects, and should be experimented with by practical agriculturists, and the results made known through the medium of the agricultural press. Borax, powdered, has been highly recommended to drive away cockroaches, &c., but with us, however, it has totally failed. One part of chloride of lime, mixed with half the quantity of some fatty matter, put on a bandage and tied around the trunk of trees, is said to prevent insects from ascending. This, however, would not last long, and might probably injure the tree, by running down the bark when heated by the sun; it would also prevent many beneficial insects from ascending to feed upon such noxious ones, as *Aphides*, &c.

Carbolic soap-suds no doubt will destroy many root-eating larvæ, and boiling hot water poured upon certain roots is said to kill the injurious maggots, and yet not to injure the roots themselves. Might this not be good, also, for the grapevine-root gall-louse so destructive to the vineyards in France, and found in our Western States? It deserves a trial at least. Salt strewed upon the surface, or plowed into the earth, is greatly recommended for the destruction of certain insects, but should be used with caution, as, if too much be used, the plants themselves would be destroyed. When operating for the destruction of the perfect-winged insects themselves, it should first be ascertained if certain species are attracted by lights at night; if so, multitudes might be lured to their destruction by burning torches, or small fires made at the proper season, when the insects are most numerous. If attracted by sweets, they may be destroyed by placing boards covered with molasses or sirup, mixed with some poisonous substance, such as fly-stone powdered, gray crude arsenic, Paris-green, &c. Glycerine is said to combine well with arsenic, and might be tried. In all cases, however, where deadly poisons are used, care should be taken to give due warning to children, by word of mouth, as well as by having the word *poison* marked on the boards used, for such as could read.

Certain insects appear abroad only at certain hours of the evening or night. For example, many moths fly only from eight o'clock to half past nine or ten; another genus or species then takes its place until eleven, and so on until the morning dawns. All these apparently very insignificant details ought to be carefully studied and noted down, so as to know exactly how and when we may expect to meet with certain insects. In short, the duty of the practical entomologist should be to inquire into the minutest detail of the lives and habits of the insects he has to deal with, as much as the physician does of the diagnosis of diseases, so as to know exactly when, where, and how they may be combated to the greatest advantage.

TOWNEND GLOVER.

Hon. FRED'K WATTS,
Commissioner of Agriculture.

REPORT OF THE CHEMIST.

The report of 1871 embraced the work of the laboratory up to the 15th of May; since that time we have been engaged in the analysis of natural fertilizers, as a specialty. The amount of miscellaneous business is rapidly increasing, and interferes materially with the prosecution of any special line of investigation, when the labor in both is required to be performed by a single assistant. We present an abstract of our work on

NATURAL FERTILIZERS.

A specimen of calcareous tufa, from Abingdon, Virginia, presented by Hon. John W. Johnson, is composed of—

Carbonate of lime	94.750
Silica and alumina	5.221
Loss	.029
	100.000

Shell-marl from Newbern, N. C., presented by J. P. Dillingham, is composed of—

Water, determined at 100° C	0.650
Organic matter	2.850
Peroxide of iron and alumina	4.001
Phosphoric acid	0.099
Lime	13.451
Potassa	0.331
Carbonic acid	10.600
Silica	68.018
	100.000

Marl from Glymont, Maryland, presented by Leonard Marbury, gives, on analysis—

Water, determined at 100° C	3.840
Organic matter	2.200
Phosphate of lime, (tribasic)	4.413
Carbonate of lime	19.639
Carbonate of magnesia	4.238
Peroxide of iron and alumina	6.859
Silica	58.990
Potassa	0.725
Chlorine	0.096
	100.000

Shell-marl from Marshall Hall, Maryland, presented by Oliver N. Bryant, is composed of—

Organic matter and moisture	2.030
Carbonate of lime	54.070
Carbonate of magnesia	1.304
Phosphoric acid	0.350
Peroxide of iron and alumina	2.955
Potassa and soda	1.000
Silica	38.291
	100.000

Greensand-marl, from the same locality, gives—

Organic matter and moisture	1.900
Carbonic acid	1.214
Phosphoric acid	0.653
Peroxide of iron and alumina	2.207
Lime	9.465
Potassa and soda	0.800
Silica	83.761
	100.000

A specimen of calcareous marl from San José, Santa Clara County, California, presented by Charles G. Thomas, shows the following composition:

Water, determined at 100° C	1.535
Carbonate of lime	58.360
Peroxide of iron and alumina	7.495
Potassa and soda	0.250
Silica	32.360
Phosphoric acid	a trace
	100.000

Two samples of marl from Prince George's County, Maryland, furnished by F. W. Poor, give the following results:

No. I.—*Shell-marl.*

Water, determined at 100° C	2.600
Lime	32.910
Carbonic acid	26.429
Peroxide of iron and alumina	4.160
Silica	33.901
Phosphoric acid, potassa, and magnesia, each	a trace
	100.000

No. II.—*Greensand-marl.*

Water, determined at 100° C	4.025
Lime	7.260
Carbonic acid	5.452
Peroxide of iron and alumina	3.950
Phosphoric acid	0.250
Potassa and soda	0.700
Silica	78.363
Magnesia	a trace
	100.000

A specimen of gypsiferous marl from near Selma, Alabama, was forwarded to the laboratory by E. Coon. On analysis, it showed the following composition:

Water, determined at 100° C	17.440
Sulphate of lime	22.355
Silica and alumina	60.205
	100.000

Shell-marl from Queen Anne's County, Maryland, presented by Thomas Hill, Baltimore, gives, on analysis—

Water, determined at 100° C	0.2700
Carbonate of lime	57.0445
Phosphoric acid	0.7097
Peroxide of iron and alumina	2.1103
Silica	39.8655
	100.0000

A specimen of phosphatic marl (mineral phosphate) from near Charleston, South Carolina, furnished by the Commissioner of Agriculture, gives—

Water, determined at 100° C	4.4750
Organic matter	33.8400
Insoluble silica	7.8620
Soluble silica	0.6650
Sesquioxide of iron and aluminum	6.2712
Insoluble phosphoric acid	16.3485
Soluble phosphoric acid	1.3860
Lime	18.0591
Magnesia	0.1360
Potassa	0.1541
Soda	1.3286
Chlorine	0.5960
Sulphuric acid	6.8712
Loss	0.0073
	100.0000

MISCELLANEOUS ANALYSES.

An alkaline deposit found near El Paso del Norte, Mexico, was reported to the Secretary of State as carbonate of potassa, by William L. Pierson, vice-consul at El Paso, and was referred to this Department for analysis by the Second Assistant Secretary of State. Its composition is—

Water, determined at 100° C	3.8168
Sulphate of soda	11.4948
Sulphate of potassa	1.3000
Chloride of sodium	5.0967
Carbonate of soda	7.3915
Bicarbonate of soda	70.9002
	100.0000

A species of yucca, which grows abundantly in rocky and sterile localities in Utah Territory, and which is used extensively by the natives as an article of food, was forwarded to the laboratory by J. E. Johnson, Saint George, Utah. The yucca has a bulbous root, which is roasted in hot sand until it is soft, in which condition it serves as food. The specimen sent to the laboratory had been roasted some thirty days, yet it showed no sign of fermentation. A proximate analysis gave, after drying—

Glucose	7.3828
Albuminoid substances	0.2168
Vegetable fiber and inorganic matter	92.4004
	100.0000

Two specimens of leaves, marked "Highland Sumac" and "Lowland Sumac," were sent to the laboratory from San Diego, California, by A. M. Gass. On close inspection of the leaves, a doubt was raised as to the botanical character of the plant from which the leaves were obtained.

To resolve this doubt, they were finally submitted to the inspection of the botanist of the Department, who pronounced No. 1 leaves from the *Styphonia integrifolia*, and No. 2 undetermined, but neither of them true sumac, *Rhus glabra*.

A proximate analysis gave for—

No. 1. (*Highland.*)

Tannin	13.10
Vegetable fiber, &c	86.90
	100.00

No. 2. (*Lowland.*)

Tannin	7.92
Vegetable fiber, &c	92.08
	100.00

A package of sumac leaves from Oregon, Holt County, Missouri, was sent by Clarke Irvine, with the request that the per cent. of tannin be determined. The leaves gave—

Tannin	23.075
Vegetable fiber, &c	76.925
	100.000

These determinations of tannin were made by the process of Löwenthal, with very satisfactory results.

A species of aquatic grass, (*Sporobolus cryptandrus*,) which is found along the southern shore of Lake Erie, produces a coarse, hemp-like fiber. A sample of this was sent to the laboratory by H. C. Beardslee, of Painsville, Ohio, for the purpose of determining its adaptation to the manufacture of paper. The fiber is composed of—

Inorganic matter	1.947
Cellulin	98.053
	100.000

showing its good quality for the use proposed.

W. A. Heirs, of New Iberia, Louisiana, sent to the laboratory a sample of peat-muck, to ascertain its value as a fertilizer. An analysis shows it to be composed of—

Water, determined at 100° C	21.300
Organic matter	38.200
Oxides of iron and aluminum	2.832
Phosphoric acid	0.678
Lime	0.320
Magnesia	0.388
Silica	35.622
Potash	a trace
Loss	0.660
	100.000

The chief manurial value of this muck is in 38 per cent. of organic matter, which is principally carbonaceous, and will make it an excellent absorbent in composting stable-manure.

A package of shale, or decomposing rock, from Spring Bluff, Adams County, Wisconsin, was sent to the laboratory by J. H. Philips, with a request that its value as a fertilizer be determined. Analysis shows it to be composed of—

Water, determined at 100° C	1.689
Silica	43.110

Peroxide of iron and alumina	20.655
Lime	5.360
Magnesia	11.560
Soda	3.446
Carbonic acid	14.258
Phosphoric acid and potash, each	a trace.
	100.000

It has not, therefore, a high value as a fertilizer; the 11.5 parts of magnesia which it contains being its most important element.

Hon. Clinton Lloyd, of Washington, District of Columbia, presented a sample of "Clark's ammoniated bone," manufactured in Philadelphia, Pennsylvania. Its composition is—

Water, determined at 100° C	6.2000
Organic matter	37.6500
Soluble phosphoric acid	8.6670
Insoluble phosphoric acid	8.0787
Lime	19.2696
Sulphuric acid	4.9648
Alkalies	0.5000
Silica	14.6699
	100.0000

Many letters have been received at this Department, from several places in Texas, asking an explanation of what the writers call "poison-soil." The phenomena of these soils are well described in a letter from G. W. Danover, Breckinridge, Dallas County, Texas; from which we make the following extract:

I send you a specimen of our poison-soils. All our soils for many miles in every direction are of the same character; therefore I suppose one specimen would be sufficient.

There is no perceptible difference between the poison-soil and that which surrounds it. It is distinguished only by the premature decay of vegetation growing upon it. It exists in limited areas, as far as I can learn, throughout the State, in every variety of soil. Sometimes cotton covering fifty acres dies on one plantation. We can never tell where it exists until we plant the ground in cotton, fruit-trees, or root-vegetables. The natural grasses, prairie and mesquite, grow well upon it. Timothy and clover are not adapted to this soil and climate. Vegetation that derives most of its vitality from the tap-root is more liable to die than that supported mainly through lateral surface-roots. It does not affect injuriously cereals, corn, wheat, &c. Trees usually grow one or two years before dying. Root-vegetables and cotton die and rot just before fully developing themselves. * * * * The soil is loamy when properly cultivated, but very tenacious when wet. It is underlaid with a thick bed of soft limestone. This is called the "black sticky land." It produces from twenty-five to seventy-five bushels of corn and from one-fourth to one and a half bales of cotton per acre when not affected by the poison, as we call it. * * * In procuring this specimen I removed the dirt four inches below the surface, then cut a slice ten inches deeper. The difficulty doubtless lies some distance below the surface, from the fact that often one stalk of cotton will die, and another standing almost against it will grow luxuriantly. On examination their roots will be found to be different in shape, the dead one having a straight root and the living one mostly lateral roots.

The specimen of soil sent to the laboratory was very dark-colored—nearly black—with a slight brown shade, and so hard that it was pulverized with difficulty. A preliminary qualitative examination showed nothing new or unusual in the soil; so, the cause of its peculiarity is to be found in the proportions of the ordinary soil-ingredients, or in the manner in which they are combined. Subjecting a sample of the soil, well pulverized, to the action of cold distilled water, we found but nine hundredths of one per cent. (.09) soluble. Not satisfied with this indication, we determined, by an ultimate analysis, to ascertain the exact composition of the soil, as the only reliable method of solving the problem The analysis gave the following composition in 100 parts:

Water, determined at 100° C	7.100
Carbonaceous matter	6.964
Humus, soluble in a solution of carbonate of soda	1.673
Insoluble humus, (extracted by caustic potassa)	0.213
Sesquioxides of iron and aluminium	14.096
Phosphoric acid	0.206
Alkalies, (potassa and soda)	0.740
Insoluble silica	63.070
Oxide of manganese	2.072
Lime	3.166
Loss	0.700
	100.000

The first observable feature in this table is the entire absence of sulphuric acid, or any other of the sulphur compounds. Next to this is the large per cent. of humus, which, in the fresh soil, most probably exists as humic acid in combination with alumina and iron, forming insoluble humates of these bases, which will account for the very small amount of soluble matter in the soil. In a clay subsoil, charged with water to the point of saturation for at least a portion of the year, the organic matter which it contains will be converted into humic acid, instead of undergoing the usual decomposition into carbonic acid, ammonia, and water, which a free exposure to the air will effect. This explains, also, the fact that crops which draw their nutriment from the soil by superficial roots are not unfavorably affected in these spots, the surface-soil being more exposed to the air and less subject to saturation. Liebig, in his Laws of Husbandry, (page 91,) alluding to this character of soils, says: "Upon deep-rooting plants, such as turnips, clover, sainfoin, peas, and beans, organic matters, accumulating largely in the subsoil, act very injuriously, especially in clay, where they decay much more slowly than in lime soil. * * * All these processes, however obscure in themselves, are put an end to by applying lime to such a field."

What this soil needs is, 1st, a thorough underdrainage which will relieve the subsoil from saturation during the rainy months, and permit the air to circulate freely through it at all times. The soft limestones of the cretaceous and tertiary formations give a substratum for the soil almost absolutely impervious to water. These strata lying nearly horizontal, as they do generally in Texas, will necessarily have depressions on their surface, forming basins which will retain the water, and saturate the subsoil, till evaporation relieves it. 2d. After the subsoil has been relieved from saturation by underdrains, it should be broken with a subsoil-plow so as to bring it more fully under the influence of the air. Subsoiling, however, will be of no value unless there is first a good underdrainage; for the rain, saturating the subsoil, will run it into a mass, and its adhesive quality will make it as compact and as impervious to the air as it was before it was broken. 3d. A heavy dressing of quicklime, deeply plowed in, would take up and neutralize a large amount of humic acid, and thus relieve other elements of plant-food which are now locked up as insoluble humates. But without underdrainage the effect of lime will at best be but temporary; for lime on a saturated subsoil tends to render it ultimately more compact and impervious. Gypsum will greatly improve these soils by furnishing sulphuric acid, an indispensable element of plant-food in which they are very deficient. We would therefore prescribe for these poison-soils, 1st. Thorough underdrainage; 2d. Subsoil breaking; 3d. A heavy dressing of lime and gypsum.

EXPERIMENTS TO DETERMINE THE INFLUENCE OF GROWING VEGETATION ON TEMPERATURE.

These experiments were conducted with the thermo-electric apparatus of Ruhmkorff. The needle was adjusted in each experiment so that its zero indicated the temperature of the room, and the graduation of the arc gave 4.8° equal to 1° F. The experiments were commenced on the 29th of June, 1872. The signs + and — indicate a temperature above or below that of the room.

Time.	Subjects of the experiment.	Temperature of sunshine.	Temperature of the room.	Deflection of the needle.	Remarks.
1872.		*F.*	*F.*	*R.*	
June 29—2 p. m.	Flower of the *Magnolia grandiflora*	105	88	—20	A sheet of white paper was exposed to the sunshine two minutes and brought to the instrument; the needle moved + 40°
Do	Leaves of the same	105	88	—15	
	Leaves of grape-vine—				
June 29—2.30 p. m.	Under side	105	88	—30	
Do	Upper side	105	88	—24	
July 1—2 p. m.	Maple-leaves, drooping with heat	106	92	+15	Observe that the stomata in these leaves were closed.
July 5—2 p. m.	Leaves of the elder, (*Sambucus canadensis.*)	104	90	+ 4	Leaves wilted from heat.
Do	Grape-leaves	104	90	—11	
July 10—9 a. m.	Leaves of *Paulina imperialis*, (tree of India.)	104	88	—15	Upper side of the leaf.
Do	......do	......	......	—22	Under side.
July 20—9 a. m.	Leaves of sugar-maple	100	80	—14	
July 20—1 p. m.	Grape-leaves	108	93	0	Leaves wilted from heat; stomata closed.
August 12—2 p. m.	Maple-leaves	108	92	—24	Shower the evening previous.

The above experiments, though not full enough to be conclusive, indicate that growing vegetation reduces temperature in its vicinity, in the ratio of the rapidity of the vegetative action. Whether this is to be attributed entirely to the evaporation of water from the leaf, or to other causes in conjunction, is a question yet to be determined. That evaporation is the chief cause of the reduced temperature is established by the fact that leaves in which the stomata are closed deflect the needle +, but still the elevated temperature did not equal that of the sunshine from which the leaves were taken. The greatest deflection + obtained from leaves was 15°, while a sheet of white paper from a sun-exposure gave 40°. As the formation of carbonic acid in the combustion of wood gives out heat, so we would infer that the deoxidizing of carbon in the function of the leaf would absorb heat. To determine this point would require a series of experiments to ascertain accurately the ratio existing between the reduction of temperature and the amount of water evaporated. Our purpose in the present experiments was to determine the effect of growing vegetation on the solar heat which it receives. From these experiments we are satisfied that the solar rays received by growing vegetation heat the atmosphere less than the same rays received on the bare earth or on rocks. Therefore growing vegetation mitigates summer heat, and to that extent influences climate.

Several experiments were made during the month of August to determine the difference between the temperature of the earth exposed to

the direct rays of the sun and that of the air with a similar exposure. Three observations were made each day, as given below.

The soil was a sandy loam, of a light-gray color, resting on a compact clay subsoil at the depth of twelve inches. It was well pulverized to the extent of eight or ten inches deep. We regret that no opportunity offered to vary these experiments in different varieties of soils and under different circumstances. The observations were continued through a week, commencing on the 13th of August, 1872. The bulb of the thermometer was placed five inches below the surface.

Date.	9 a. m.		12 m.		3 p. m.		Remarks.
	Air.	Earth.	Air.	Earth.	Air.	Earth.	
1872.	*F.*	*F.*	*F.*	*F.*	*F.*	*F.*	
August 13	86	88	100	98	104	99	Sun obscured at 12 m., clear at 3 p. m.
August 14	92	88	104	99	109	100	Clear; bright sunshine.
August 15	90	86	96	92	90	89	Shower previous night; variable sunshine.
August 16	......	....	......	....	......	....	Raining; no observations.
August 17	85	80	92	84	94	88	Clear; bright sunshine.
August 18	86	82	94	86	96	89	Variable sunshine.
	Mean dif. 3.8.		Mean dif. 5.4.		Mean dif. 5.4.		

It will be seen from these observations that the difference between the air and the soil is least in the morning, attains its maximum at noon, and maintains substantially the same relations till 3 p. m. To reach any reliable conclusion, however, these experiments should be repeated at different seasons of the year, and in several varieties of soils. It is an interesting field of research, and one which we hope those who have opportunity will not fail to occupy.

The subject of

THE WASTES OF CITIES AND TOWNS

was referred to this division for investigation, and, as far as time and opportunity would permit, that investigation has been prosecuted by a pretty thorough examination of the various reports made from time to time on the sewage of the great cities of Europe and America, and its effect on rivers, springs, and other streams of water. In addition to this we have opened a correspondence with parties on both sides of the Atlantic, from which much important information has been obtained. The subject is one of greater magnitude than has heretofore been apprehended; and its importance is not by any means limited to its sanitary relations, though these constitute an important phase of the subject.

The investigations developing the laws of health and the general advancement of sanitary science in the last half-century have created a lively interest in the subject of the best method of disposing of excrement, garbage, and other refuse matter from cities, towns, and manufactories. The habit of hiding such waste matter in rivers so polluted many of the waters of England as to call for a remedy from the government. In 1855, by a royal warrant, a commission was created to inquire into the extent of this river-pollution, and to suggest a remedy. In 1868 this commission was revoked and a new one issued with enlarged powers. This commission has made four very full reports, from which we learn something of the alarming extent to which the rivers of England

have been polluted, and thus made the vehicles of disease to those on their borders.

From Paris and from many other cities of Western Europe similar complaints have reached us. Prevalence of typhus, of cholera, of epidemic diarrhea, and of other zymotic diseases have been traced directly to the defective methods of disposing of the waste matters which accumulate to such an extent in all cities and towns of any considerable magnitude as to soon become an intolerable nuisance. There is but little doubt that the plague which in other years desolated the great cities of the world—"the pestilence that walketh in darkness"—was really nothing more than the legitimate result of an utter disregard of cleanliness and other sanitary conditions.

This subject has a very interesting history, and one that would be very instructive, had we time and space to develop it. Perhaps the most ancient regulation concerning this matter is found in the wise sanitary provision of the Hebrew lawgiver, (Deut. xxiii, 12, 13;) but in most of the ancient cities, the only provision for disposing of waste matter was to consume it by fire, as in the fires of Hinnon at Jerusalem and the fiery furnace at Babylon. In Egypt, the wastes were annually carried away by the inundation of the Nile, or covered up by the deposits from its turbid waters.

Rome led the way in making provision for carrying off the wastes of the city by subterranean sewers. The Cloaca Maxima, built by Tarquin about six hundred years before our era, was the first experiment in this line, and has hardly been excelled since. This ancient work was cleaned, repaired, and greatly extended by Agrippa in the reign of the Emperor Augustus. He turned the waters of the aqueducts through the sewers, hoping thus to secure the cleanliness of the city, but only succeeded in poisoning the Tiber and rendering the villas along its shores almost uninhabitable. The example of Rome has been very generally followed by modern cities, with substantially the same results. London began the construction of her system of sewers in the year 1225, and has been extending that system as the wants of the city from time to time appeared to demand. Paris began the great work, which literally makes that city stand on arches, about two centuries later than London, but her sewers are said now to be the most perfect in the world. Yet neither Rome, London, nor Paris, nor indeed any other city, European or American, has succeeded in establishing the sanitary condition at which they aimed, and to secure which these enormous expenditures were made. But their failure was to be expected, for there is the violation of a natural law lying back of all this—a law, the disregard of which, has led to the failure of every attempt to establish a favorable sanitary condition in cities by means of subterranean sewers. It is the law of compensation—the law by which the wise Creator proposes to balance consumption and production. In her economy, nature makes no provision for losses, but proposes to utilize everything. Wherever there is a nuisance, therefore, some law of nature is violated—something is out of place. To feed and clothe populous cities, a constant draft is made on the elements of fertility in fields near by or remote, for which the cities make no return. Can these fields, however fertile, continue to feed and clothe the millions of the cities and yet not feel the exhaustive drain?

The decadence of nations and the downfall of empires are more deeply involved in this law of compensation than political philosophers and statesmen have apprehended. No nation has long survived her ability to feed and clothe her people from the production of her own soil, nor

has any nation or city fallen into ruins while her fields maintained their fertility. Even before the Punic wars Rome had drawn from the rich fields and faultless climate of Italy the material to feed and clothe the thousands within her walls for nearly five hundred years, without any compensating return. At length a scarcity of food drove the nation to war, in order to procure corn to distribute among the people, and thus temporarily avert the famine that yearly threatened them. But these supplies, the trophies of wars but little better than robberies, were swallowed up by the insatiable sewers of Rome, and the fields of Italy remained impoverished, though Sicily, Sardinia, Spain, and the African provinces poured their wealth of food into her capital. The treasure, once there, was lost forever in the polluted waters of the Tiber.

The exhaustion of her soil and the consequent uncertainty of the food-supply was the principal cause of the downfall of the republic, and final overthrow of the empire which succeeded it. Scipio, two hundred years before Christ, fed multitudes daily from the public stores, and the conquered provinces were taxed one-tenth of their harvests, to supply the means for this distribution of food; and even with this provision repeated famines occurred. Augustus Cæsar is said to have fed 300,000 of the population of Rome at the public expense during the greater part of his reign. When the census of Julius Cæsar showed a decrease of population in the city, that shrewd statesman did not hesitate to refer it to the scarcity and uncertainty of the food-supply. But his laws, in the emergency, were as ineffectual as the agrarian project of Caius Gracchus had been to restore to fertility the wasted fields of Italy. In this state of pauperism, who will be surprised that the Roman citizen lost his traditional independence, and descended to a condition the most servile and abject? an effect to be traced directly to the uncompensated drain of the cities on the fertility of the fields.

The lesson of Spain is no less instructive than that of Rome. Strabo speaks of the plains of Andalusia producing a hundred-fold. At the beginning of the tenth century Moorish Spain supported from her own soil a population of 30,000,000. At the time of the Roman conquest the city of Tarragona is represented as having a population of 1,000,000, and when in possession of the Moors it numbered 350,000, but at the present it has scarcely 15,000 inhabitants. When we learn that Catalonia, once the granary of Southern Europe, now only yields a scanty harvest once in two years, and that Andalusia, at one time so fertile, now gives a harvest but once in three years, we may learn this salutary lesson—*no nation can long survive the exhaustion of its soil.*

On the other hand, the cities of Egypt, though not less wasteful than the contemporary cities of Asia and Europe, yet surrounded by fields whose perpetual fertility is insured by the annual inundation of the Nile, have always maintained a respectable population, at least in numbers. Cairo at the present time has not less than 300,000 inhabitants, and other cities are quite populous. China and Japan can justly claim an antiquity which carries their history up to the very infancy of the race. Now, in what particular does China or Japan differ from the old nations of Western Asia, or Southern Europe, which live now only in the crumbling ruins of their once magnificent cities? Chiefly in this: China and Japan by a rigid system of compensation, which requires that the fields shall receive from the cities as much as they give, have maintained their capacity for production, and consequently have been able to feed the swarming millions of their population, and thus to prolong their national existence indefinitely. Had China or Japan sent abroad her food to be consumed in foreign lands, or buried the nitrogen, phosphoric

acid, potash, and lime of her crops in the sewers of her great cities, to be washed out and lost forever in the ocean, they would have been forgotten a thousand years ago.

Great Britain and the other states of Northwestern Europe have felt the pressure of this inexorable law for the last two or three centuries; but instead of resorting to conquest, as Rome did, to put off the evil day, these nations have sought a remedy in commerce and manufacturing, by which to draw from foreign lands the elements of their fertility, to bury these in the sewers of their own cities. How well they have succeeded in this the diminished crops and failing fertility of *our fields* bear abundant evidence. This Atlantic plain which once produced luxuriant crops of wheat, corn, and tobacco, but now much of it given up to old-field pines, is a melancholy witness of their sagacity and our folly.

After the researches of Sir Humphry Davy had unfolded the importance of this subject, Great Britain adopted a new policy and began the importation of fertilizers to supply her fields with that which her cities are wasting; and shortly the other nations of Western Europe followed the example thus set. Krepp, in his work on sewage, says:

> The fertilizers imported [into England] consist chiefly of bones and guano. For the first-named article large depots have been established all over the continent of Europe, to receive whatever scavengers and bone-pickers can possibly collect in streets, courts, butchers' stalls, &c.; and ship-loads of bones are thus annually sent to England, amounting from Bavaria alone to some 6,000 tons. Besides this, nearly all the old public cemeteries have been ransacked, among others the catacombs of Sicily, which are now completely exhausted. Nay, even the solemn repose of the warriors fallen on the glorious fields of Leipsic, Waterloo, and the Crimea have been disturbed.

In 1841 England began to import guano from the Chincha Islands, and from that date to 1860 the average importation was 20,000 tons, but in 1865 it rose to 170,945 tons, valued at $8,425,000. It is, however, estimated that the city of London alone transmits through her sewers into the Thames ammonia, phosphoric acid, and potash equal to all that is contained in the eight millions of dollars' worth of guano imported. In other European countries, though using less guano than England, yet this importation is sufficient to constitute a serious drain on their resources. In 1862 Belgium imported 50,270 tons of guano; France, 44,300; Germany, 27,644, and the United States 12,470 tons. Since that time the importation has rather diminished than increased, owing to the advanced price from the failing supply. But even a superficial observer will see that no importation of the elements of fertility from abroad can long atone for the violation of this law of compensation, in its spirit, however we may conform to its letter. The penalty, though long deferred, must finally be paid. Nature is very exacting. In her economy she wastes nothing. A vegetable grows at the expense of the air and the earth, but when its life is ended, it in time returns to each of these every atom which each has furnished, distributing its returns with even-handed justice. Through the vegetable world animals derive the materials for their growth, and for the repair of their tissues from the same source of supply, the air above and the earth beneath. While an animal is growing it returns to these sources daily less than it takes by the amount of its increase in weight, but after it has attained its full growth, the equal balance of giving and receiving is adjusted. After this, if the animal is gaining in flesh or fat, it takes more than it returns; on the other hand, if it is losing, it gives more than it takes; and finally when it dies, it returns to the earth and air the original capital which it borrowed in its growth, and, when the two sides of the ledger of life are compared, not an atom of matter is lost. The system

of compensation is complete and absolutely perfect till man interposes his arrangements to break up the harmony of nature, by placing the wastes of animal life beyond the reach of the organizing forces which would economize them in the ever-recurring circle of life.

Few persons think how seriously the important question of food-supply is affected by the waste of excrement in our cities and towns. This, of course, will vary somewhat with the quality of the food on which the population subsists, but a general estimate of value may be made from the observations of Baron Liebig, Professors Way, Hoffman, Boussingault, &c. From these authorities, English writers have generally concurred in an estimate of 10*s.* ($2.30) per head as the annual value of the ammonia, phosphoric acid, and potash contained in the solid and liquid excrement of an adult, or 8*s.* ($1.84) per head for the whole population. This valuation is based on a number of analyses of solid and liquid excrement in the usual proportions, which give an average in 100 parts—

	Solid.	Liquid.
Water	75.00	93.68
Carbonaceous substances	12.20	4.15
Ammonia	1.70	1.73
Phosphoric acid	1.06	0.24
Potash	0.29	0.20
Other mineral substances	19.75	
	100.00	100.00

This table reveals the fact that if human excrement was deprived of its water, the dry residuum would contain as high a percentage of ammonia as the best specimen of Peruvian guano. It would also be but little inferior to guano in the important element of phosphoric acid. At the estimated prices of ammonia and phosphoric acid, this table will give a much higher value to excrement than that named above; but the difficulty of collecting all the wastes of a city, and the almost unavoidable loss of ammonia in the evaporation of the crude mass to a convenient state of dryness, have reduced the practical value to the English standard of 8*s.* per individual of the whole population. It must be remembered, however, that this is an estimate of what might be saved by utilizing this single waste, and not the amount actually lost in the sewage of cities. But even at the low estimate we have made of this single item of waste, the loss to a city of 100,000 inhabitants would amount to $184,000 per annum.

Professor Voelcker estimates that the use of 280 pounds of guano on an acre of land gives on an average an increase of twelve bushels of grain. At the same rate the excreta of an adult for one year, if applied to an acre of ground, will furnish the elements for at least ten bushels of wheat. It will really contain the ammonia and phosphoric acid for one hundred pounds of wheat, though in potash, lime, and magnesia it will fall short.

From this stand-point we may begin to realize the magnitude of this loss, and can calculate, with a good degree of certainty, its ultimate consequences. It is but fair, however, to say that all this is not absolute loss. A large proportion of the nitrogen contained in sewage and in the contents of cess-pools and privy-vaults is converted into ammonia, which, in the gaseous state, escapes into the air, to be washed out

by the first rain that falls, and absorbed by the earth or wasted on the waters of rivers, lakes, or oceans. A small portion of the contained phosphorus and sulphur may also combine with hydrogen, and thus forming volatile compounds, may be carried by atmospheric agencies to the fields, where the absorbent power of the soil may retain them for future use. But these natural distributions amount to only a small proportion of the value of these wastes; and, moreover, these distributions are made with the most rigid impartiality, the fields where we most need them getting no more than the woodlands or the barren mountains.

The magnitude of this loss, and its relation to the prosperity and stability of nations and countries, are attracting the attention of the best minds beyond the Atlantic, and various methods have been proposed looking to the economizing of these waste values, and at the same time relieving the cities of an intolerable nuisance and a fruitful source of disease. Many of these methods have, at great cost, been submitted to practical tests in the cities of Europe, as well as in most of the larger towns and cities of our own country, but without any very satisfactory results as yet. Most of these methods of purifying cities look more to the sanitary phase of the question than to the interests of agriculture; but even in the matter of improving the health of cities they have been but little better than failures.

To carry away the waste matter from cities, by means of water, through subterranean sewers is merely hiding the filth till it can be transported beyond the city limits, to contaminate the streams and pollute the air of other regions. How far this has been carried may be learned by an examination of the several reports of the English "River Pollution Commission." Even the cities themselves are by no means free from the poisonous influence of sewer-gas, which in spite of all precautions will escape to some extent, and to that extent affect unfavorably the health, without the true cause being even suspected. But where the outfall of sewage is in tide-water, the filth accumulates to such an extent as to be a fruitful source of disease, and frequently, as in the harbor of New York, to demand large outlays in dredging to keep the channels of commerce open. To obviate these effects, attempts have been made to purify sewage by filtration, but as the greater part of the polluting matter is in a state of solution in the water, the remedy has proved very imperfect. The organic matter in this state is subject to constant changes which may convert it into noxious gases, and these, escaping, pollute the air for miles around; or it may form combinations which are insoluble and thus be precipitated to fill up the streams or obstruct the harbors into which the sewage is poured. Artificial methods of precipitation have proved hardly more successful than filtration. The fertilizing elements of city wastes, when mixed with the water of sewers, may be regarded as practically lost, so far as the interest of agriculture is concerned. The method of disposing of sewage by carrying it to the country in pipes, either by the force of gravity, or by aid of powerful pumps, for the purpose of applying it to the fields in the form of irrigation, has been attempted. It has been confidently claimed that this method is a success, both in a sanitary and agricultural point of view. But if saturating the soil of a city with the contents of cess-pools and privy-vaults conduces to sickness among the inhabitants, the same results will be likely to follow from sewage irrigation when it has been continued long enough to saturate the soil. The chief difference, probably, will be that fewer persons will be affected by it in the country than in the city, because the exposed population is less. Moreover, the utilization of the

wastes must be confined to so limited a surface that it can hardly be regarded as fulfillment of the law of compensation. Tons of phosphoric acid, ammonia, and potash, in the form of flour, beef, and pork, are collected from millions of acres and brought to our crowded cities to be ultimately thrown into the sewers. Now, what does it avail to the fields a thousand miles away that a few hundred acres in the immediate vicinity of the city are rendered fertile by sewage irrigation? What is needed is the separation of the fertilizing materials from the crude mass, by this means reducing its bulk and weight to such dimensions that, like guano, it will bear transportation thousands of miles.

That portion of food-material which was originally derived from carbonic acid and water, and which constitutes about 80 per cent. of the whole weight, need not be returned, as these compounds are abundantly supplied everywhere. By a complete separation of water from excrement, the weight to be transported will be reduced more than four-fifths, and by deodorizing the remainder it will have such a form that it can be transported to any place where it may be needed. This is indeed the desideratum, though it appears to be the point that has been most overlooked in the protracted investigation to which this subject has been submitted. Almost every effort to dispose of the waste matter constantly accumulating in cities has been in the direction of adding to the bulk and weight, thus rendering transportation to any considerable distance impracticable.

To mix sewage with large volumes of water, as is done in most of our cities, is not only to waste the manure, so far as the country at large is concerned, but it sadly fails of its aim as a sanitary measure. In farm-houses, and in villages and small towns, Moule's earth-closet meets the requirements in a manner which admits of but little improvement. It is also well adapted to the use of barracks and soldiers' quarters, to asylums, hospitals, and prisons, where the care of the closets can be made the duty of a special agent, and where the accumulation of excreta is not too large to be used, economically, in the immediate neighborhood; but it violates the correct principle of sewage economy by increasing, instead of diminishing, the bulk and weight of material to be transported. In large cities, therefore, the introduction of the "earth-closet system" has met with difficulties which appear to be practically insurmountable. The solid and liquid excrement of an adult in health may be estimated at three pounds per day, or two pounds each as the average of a mixed population. Now, it has been found in practice that three times this weight of dry earth is required to absorb the water and deodorize the excrement. This would be six pounds for each individual daily. A city of 100,000 inhabitants will require the preparation and distribution of 600,000 pounds of dry earth every day. This 30,000 tons of earth has not only to be distributed, but it must be collected and removed with the additional weight of its absorption, amounting now to an aggregate of 40,000 tons. But, worst of all, this process has so diluted the product and increased its weight, that its manurial value will not pay the expense of its transportation beyond the near vicinity of the city, so that to the country at large it is virtually lost. Even if these objections could be overcome, yet in the absence of any general supervision over its use in private families, the earth-closet, in cities, will evidently prove a failure.

The limits of this paper will not permit a description of the various methods which have been proposed, and, to some extent, adopted, for collecting and utilizing their wastes in the various cities of the world. The number and variety of the methods proposed prove that, to the

present date, no plan has been adopted which fully meets the requirements of the case. But while this is true, it is also true that in discovering the defects of these various systems and plans we have made progress in the direction of the ultimate end to be accomplished, to wit: the complete removal of all waste matter from cities without nuisance or annoyance to the inhabitants, and the separation therefrom of all extraneous substances, leaving only the essential elements of plant-food to bear the expense of transportation.

The Chinese method of collecting and transporting the excrement of a city through its streets, in open vessels, will so offend our ideas of delicacy as to forbid its adoption in any of the cities of our country at least. The first and perhaps the most difficult problem to be solved in this relation is, the removal of a large bulk of material, naturally offensive, without disgust to the more refined sensibility of our civilization. To accomplish this object, some arrangement embracing Captain Liernur's pneumatic system of collecting night-soil will, perhaps, be found best adapted. At least, some mode of collection by means of exhausted reservoirs, and conveyance through the streets in air-tight vessels, must be adopted to accommodate our American ideas of decency. Collections must be made frequently, and in warm weather daily, or chemical agents must be used to prevent fermentation. This will be necessary, not only for the health and comfort of the inhabitants, but also to secure the full value of the material collected. The tendency of nitrogen, phosphorus, and sulphur to combine with hydrogen, forming volatile compounds which readily escape into the air and are lost, is a matter demanding more attention than has hitherto been given to it. Human excrement, on an average, contains the elements of about 20 per cent. of ammonia, after deducting the water; but if that ammonia is formed in exposure to the air and without chemical provisions to retain it, less than one-fourth of that amount will be available. It is from this cause, chiefly, that the statements of scientific men, as well as of practical farmers, on the subject of the manurial value of excrement, are so varied and condradictory. One makes his examinations of the article in its fresh state; another, after it has undergone fermentation, and the volatile compounds have escaped; and hence the discrepancy.

In the second place, some method must be devised to separate the water, amounting to about 90 per cent., with which the valuable material is mixed. It is at this point that Liernur's pneumatic system fails to meet the requirements in disposing of sewage. It proposes, after collecting the contents of cesspools and vaults, to transport the whole, in its crude state, to the fields where it is to be used as a manure. The 90 per cent. of water which he thus transports at great expense is of no more value than that which flows in the river or descends from the clouds. Means must be devised for the separation of this water, that the remaining 10 per cent. of really valuable material may be so reduced in volume and weight, and so changed in form, as to bear transportation to any place where it may be most in demand. It has been proposed to effect this object by precipitation, but there are chemical obstacles in the way which, in the present state of our knowledge, appear to be insurmountable. Evaporation presents itself as the only practical method of accomplishing this object. Before evaporation is attempted, it will be necessary to convert the ammonia which may be present into a sulphate, a chloride, or some other form that will be involatile at the temperature employed for evaporation. To the method of desiccation by solar heat there is the objection of the intolerable nuisance produced by the escape of the fetid compounds of sulphur and phosphorous with hydrogen. Desiccation

by artificial heat is expensive and is liable to the objection against solar evaporation. This, however, may be obviated by conducting the evapo-ration in closed vessels and passing the vapor through a deodorizing solution, or, what would be, perhaps, cheaper and equally effectual, passing it into the furnace.

There remains, however, a formidable objection to artificial desiccation of sewage—the enormous cost of evaporating 2,000 cubic feet of water daily, to recover, in an available form, the valuable material in the wastes of a city of 100,000 inhabitants. But no cheaper method has been devised which will at once accomplish the two objects, to wit: Economizing what is valuable in the sewage and securing the health and comfort of the inhabitants.

The practicability of this method of disposing of sewage, and economizing, in a form capable of being transported to a distance, all that is valuable in it, has never been fully tested by actual experiment under the guide of science. A company, with a capital of £500,000, has lately been formed in England for the purpose of submitting this question to a practical test. The company has secured the services of William Hope, esq., as engineer, and Professor J. T. Way, as consulting chemist. These names afford a guarantee that the experiment will be faithfully made in strict accordance with the principles of science. Even though the cities may be required to pay a heavy bonus to carry out a system of thorough cleansing that will secure to them health and comfort, and at the same time contribute to maintain the productiveness of the soil from which they are fed, they can well afford to bear the burden. The present imperfect system costs the city of Paris 9,000,000 francs annually, while the products of the waste matter are worth but 10 per cent. of that sum. A perfect system, could one be devised, would hardly be more expensive. Other cities fare no better than Paris; many of them not so well.

How deeply the importance of this subject is felt in the more advanced circles of our civilization is indicated in a remark made by the managers of the Vienna Exhibition for 1873. In their announcement of special programmes they say:

> How enlarged we find the amount of the useful material and the means of satisfying our requirements, by a retrospective view of the last ten or twenty years only! It suffices to single out from the list of substances, the value of which has been thus increased, one more, much despised, material, viz, human excrements. Without contradiction, these are considered as some of the most disgusting wastes; nevertheless China and Japan mainly owe their flourishing agriculture to the extensive use made of them, and one of the greatest chemists of our own time, Baron Liebig, has acknowledged that they contain the means of restoring to the soil of Europe its power of production, a power which will soon be exhausted otherwise.
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> Considering this, is it not to be called one of the greatest absurdities to spend millions in getting rid of a substance which would, if we made proper use of it, make us, by several millions, richer?

Thus we see the magnitude and weight of this subject is commanding the attention of agricultural chemists, of sanitary philanthropists, of political economists, and should, in its broader reaches, address itself to the statesman who would explore the causes of national decay and ruin.

By way of recapitulation, we present this subject condensed into a few maxims:

1. The measure of a nation's prosperity, and the security of its prolonged existence, are involved in its capacity to produce human food and clothing from its own soil.

2. The capacity to produce food and clothing can be made permanent only by a strict observance of that law of vegetable chemistry which

requires that there be faithfully returned to the soil an equivalent of all the mineral elements taken from it in the crops.

3. If the substances necessary to make this compensation can be advantageously procured at home, it is bad policy to import them from abroad.

The subject of introducing the manufacture of

BEET SUGAR

into this country is attracting much attention from that class of our citizens who are studying questions related to our national independence, productively.

The manufacture of sugar from beets is a modern industry, dating only from the early years of the present century. It was in the year 1747 that Margraff, a Prussian chemist, discovered that sugar existed in an available form in beet-roots, and advised the cultivation of them for the purpose of making sugar. Nothing more was done in the matter till 1773, when Achard, under the patronage of Frederick the Great, began a series of experiments to test the practicability of the project. The death of Frederick, however, put a stop to the experiments before any satisfactory results had been attained. Achard resumed his experiments in 1795, in which year he cultivated 60 acres of beets. In the year 1799 he presented several loaves of beet-sugar to the King of Prussia, accompanying them with a report in which he states that he had been able to produce a good quality of raw sugar at 65 centimes a kilogram, or about 6 cents per pound; and expresses his belief that his processes were susceptible of improvement that would greatly reduce the cost. This report of Achard attracted the attention of the French *savants*, and a committee was appointed to investigate the subject. On this committee appear the names of the most distinguished chemists of France. The report which they made states that Achard did not obtain more than 1 per cent. of sugar from the beet-roots, and under this information the enterprise, for the time, appeared to die. It was, however, revived by Napoleon I, who appointed a new committee to conduct original experiments on the subject. M. Deyeux, as chairman of this second committee, made his report in 1810, presenting with it samples of sugar equal to the best cane-sugar. It is unfortunate that this report does not state the per cent. of sugar obtained, nor the cost of its production; but we learn from other sources that M. Barruel about this time obtained only 6 per cent. of juice, while the yield of sugar was only 1½ per cent., and the cost was about 30 cents per pound. In 1812 the blockade of France favored the beet-sugar industry, and liberal bounties were offered to stimulate the new branch of business. At one time $200,000 were placed in the hands of the minister of agriculture to promote the sugar production. The overthrow of the Napoleon dynasty in 1814 cut off the government bounties and threatened the entire destruction of the beet-sugar business. M. Delisse appears to have been the only manufacturer in France who survived this shock; and a duty of 50 per cent. on foreign sugars, which was levied by the restored government, coming to his relief, he was soon able to lead the business in France. M. Delisse claims to have obtained 5 per cent. of sugar from his beets, at a cost of 85 francs per hundred kilograms, or about 7 cents per pound. From 1820 to 1825, under government protection, sugar manufactories increased largely, so that in the latter year one hundred establishments were reported, and France produced 5,000 tons of sugar. In 1836, four hundred and thirty-six factories were in successful operation; but in the next

year the government not only withdrew its protection but levied a duty of 15 francs per hundred kilograms (1¼ cents per pound) on domestic sugars. This resulted in the failure of one hundred and sixty establishments in France. Under this reverse, the production of sugar, which had risen to 49,000 tons in 1837, fell to 22,000 in 1842. From this date, the history of beet-sugar industry is but the record of a struggle with the cane-sugar of the tropics. From the present state of this conflict it is quite evident that the struggle must terminate in the triumph of beet-sugar throughout Northern Europe at least. Except in the immediate vicinity of the sea-board cities of France, foreign sugar has entirely gone out of use. The same is true of Germany and Holland.

The manufacture of sugar from beets is rapidly becoming an established industry throughout all Northern Europe, and the amount produced is not only supplying the demand for home consumption in those countries, but beet-sugar is beginning to compete favorably with cane-sugar in the markets of the world. Even England, with her commercial facilities and her favorable relations to the cane-sugar producing countries, pays annually nearly £2,000,000 for beet-sugar. In 1869 the production of beet-sugar in the states of Northern Europe is said to have amounted to 62,823,115 tons, and as the increase is at the rate of 10 per cent. annually the production now probably reaches 65,000,000 tons. The steady increase in this branch of production is not only without government protection at present, but under the pressure of a heavy special tax. In France this tax (amounting to about $50 per ton) is levied on the sugar produced, while in Germany the tax is laid on the beets raised. This is often as high as $40 per acre. Yet, under the influence of favorable climate and soil, with the application of science and cheap labor, the beet-sugar industry has established itself in these countries so firmly as to be beyond the reach of competition, notwithstanding the onerous tax to which it is subjected. The introduction of this new industry in Europe has saved at home a vast sum of money that would otherwise have been sent abroad for sugar; it has increased greatly the consumption of that article among the middle classes in society; it has given labor to thousands during the season of the year when they would have been otherwise unemployed; and it has greatly improved the agriculture of the sugar-producing countries by introducing a more thorough system of cultivation and a new element in the rotation of crops.

The practicability of economically establishing the manufacture of sugar from beet-roots in the United States is yet an open question. The earliest experiment in this direction, of which we have any record, was made by David L. Child, of Northampton, Massachusetts, who in the year 1838 produced 1,300 pounds of sugar from beets grown on his premises. No details of his experiment are preserved, further than that his ground yielded 13 tons of beets per acre, at a cost of $42. From this date to 1863 no efforts were made to repeat the experiment of Mr. Child. In that year, Gennert Brothers, from Brunswick, in Germany, bought a tract (2,400 acres) of land at Chatsworth, in Livingston County, Illinois, for the purpose of entering into the beet-sugar business extensively. This enterprise, after struggling with a series of mishaps and failures, owing to an ill-chosen soil, seasons of drought, inferior seed, &c., yielded to the pressure of unfavorable circumstances, and in 1870 the establishment was removed to Freeport, Illinois, where a similar experiment had been in progress since 1866, and which is giving fair promise of success, having produced in 1870 a yield of 200,000 pounds of sugar of a fair quality, and at a reasonable cost.

In 1867 Messrs. Bonesteel and Otto organized a company at Fond du

Lac, Wisconsin, for the manufacture of beet-sugar. The capital of this company was but $12,000, and the works which they erected had a capacity of only 10 tons of beets per day. Spring floods and summer drought operated unfavorably on the prospects of this company, and in 1869 Messrs. Bonesteel and Otto having received a proposition from California, removed to that State, and in 1870 joined the recently organized Alvarado Beet-Sugar Company. A co-operative enterprise of German farmers for the manufacture of beet-sugar was formed at Black Hawk, Wisconsin, in 1870, and though they are working with but a small capital their success has been quite encouraging. An imperfect supply of water appears to be the principal obstacle in the way of their success.

In the year 1860 Mr. Speckman made an attempt to cultivate the beet for sugar in the vicinity of San Francisco, California. The soil proved to be too highly charged with saline matter, however, and he abandoned the project. In 1869 Mr. Wentworth, of Alvarado, made a few hundred pounds of beet-sugar, which so encouraged capitalists that a company, under the style of the Alvarado Sugar Company, with a capital of $250,000, was formed by General Huchison, and Messrs. Bonesteel and Otto, of Wisconsin, experienced sugar-manufacturers, were induced to take the management of its affairs. In 1870 drought interfered with their operations, but in 1871 they produced 15 tons of beets per acre, with an aggregate yield of over 1,000,000 pounds of sugar from the crop. The results obtained are so favorably regarded that two other companies have been organized in California, and the beet-sugar enterprise in the Pacific States is, by many, already deemed a success.

Another experiment, and by no means the least important, has been conducted by Professor Gœssmann, of Amherst College, Massachusetts. In this experiment, conducted on comparatively a small scale, with an apparatus extemporized for the occasion, and consequently inferior to that which would be used in a regular sugar factory, he succeeded in obtaining from 8 to 9¼ per cent. of sugar from the beets raised, which is fully up to the highest European standard. His yield was from 1,900 to 2,000 pounds of sugar per acre.

The questions of climate, soil, manner of cultivation, and modes of treatment in separating and crystallizing the sugar, adapted to the peculiarities of the beet grown in this country, must all be determined; which will require time, and a patient investigation by men of science, backed by capital. Some of these conditions are already known, but much remains yet to be discovered. We cannot too highly commend the example of the Massachusetts Agricultural College in taking the lead in this investigation.*

The beet is a biennial plant, and like others of that class stores away in the root, or other underground organ, by its first year's work, the prepared material for perfecting the seed. In southern climates, where the long summer gives an opportunity, in the first year, to do much of the work directly, there is less necessity for storing away, in the root, so large a stock of prepared material. Hence we find such vegetables as the potato, the turnip, the beet, &c., attaining their highest perfection in the higher latitudes, where the short summers require a very rapid second year's growth. Conforming to this law we find the sugar-beet succeeding best in the northern portions of France and Ger-

* Since writing the above we have received the following interesting report from the University of Virginia. The crop, as indicated in another report, is fully up to the average of European crops, in quantity. Perhaps many of the valleys of the Alleghany Mountains, as well as the foot-hills on their eastern margin, will have the intensity of summer heat so modified as to be well adapted to beet culture.

many, in Belgium and in Russia, while in Spain and Italy the beet-sugar industry has never been able to sustain itself. The actual climatic condition demanded, however, appears to be a low intensity of heat during the summer months. A high summer temperature tends to the development of woody fiber in biennial roots, at the expense of starch and sugar. With this view of the subject it would be hazardous to attempt beet-sugar making in that section of country east of the elevated plains on the eastern margin of the Rocky Mountains and south of the fortieth degree of latitude. The northern limit of profitable beet culture in Europe has not been clearly ascertained; but as the Vilmorin, which is esteemed the best beet cultivated, requires at least four months to perfect its growth, it will follow that where this length of summer can be depended on, the beet may be profitably cultivated. In measuring the season, it will be proper to remember that this crop is not easily injured by light frosts, whether in the spring or fall. The beet demands a uniform moisture in the atmosphere, rather than a very wet, or very dry climate. It endures either extreme badly.

The soil best adapted to the sugar-beet is a deep sandy loam well underdrained. The comparatively small amount of nitrogenous substance in a good sugar-beet will not tolerate the free use of manures rich in ammonia. Wild soils and newly-broken prairie land should, on this account, be avoided in selecting a field for the raising of beets. Soils abounding in mineral salts should also be avoided, as these seriously interfere with the separation and crystallization of the sugar.

As a general rule it will be better to apply to the previous crop what manures it may be necessary to use, and abstain from their use directly on the beet crop.

In beet culture, as in every other variety of farming, the first care is the proper selection of seed. Several kinds of beets are in use in France and Germany. Among these Vilmorin, the White Imperial, and the White Silesian are in good repute among European sugar-makers. Which will succeed best in our soil and climate, or whether some new variety will be demanded, are questions which can be settled only by actual experiment.

The beet requires deep cultivation. To this end the subsoil should be well broken, and the soil thoroughly pulverized. Large roots are not desirable in the manufacture of beet-sugar. From one to two pounds' weight are found to be the most economical roots, yielding the largest amount of sugar with the least waste. In planting the beets, it will be economy, in this country, to make the rows a sufficient distance

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Determination of sugar in juice of sugar-beets cultivated on experimental farm, University of Virginia, season of 1872.

	Sugar in juice. (By polariscope.)
White Silesian sugar-beet: Seed from United States Department of Agriculture, (grown in France;) average size of roots, $5\frac{1}{2}$ inches long by $3\frac{5}{8}$ inches maximum diameter; average weight of roots 1 pound $8\frac{1}{4}$ ounces	11.75 per cent.
Carter's prize nursery sugar-beet: Seed from United States Department of Agriculture, (imported from England;) average size of roots, $5\frac{1}{4}$ inches long by 3 inches maximum diameter; average weight of roots, 1 pound	13.72 per cent.
Vilmorin's improved sugar-beet: Seed from United States Department of Agriculture, (grown in France;) average size of roots, 6 inches long by $3\frac{7}{8}$ inches maximum diameter; average weight of roots, 1 pound $14\frac{1}{2}$ ounces	12.54 per cent.
White sugar-beet: Seed from R. Buist, jr., Philadelphia; average size of roots, $7\frac{3}{4}$ inches long by $3\frac{7}{8}$ inches maximum diameter; average weight of roots, 2 pounds $1\frac{1}{2}$ ounces	10.17 per cent.

apart to admit of horse-cultivation, but the space between the plants in the row need not exceed eight inches. After thinning the plants properly, the cultivation consists in keeping the ground loose and free from weeds. As soon as the lower leaves begin to die, the crop should be harvested, but care must be taken that the roots be not exposed to air and light. The tops should be cut off and the roots covered with earth so as to secure them from the influence of air, light, and frost, until they are used in the factory.

A mistaken notion has obtained, to some extent, among farmers, that the beets can be made into sugar on the farm. The profitable manufacture of beet-sugar requires a well arranged factory and expensive machinery, and withal, it demands both skill and science in the management of all its processes. Without these, an attempt to engage in beet-sugar making will be most likely to end in a failure—with these, and backed up by sufficient capital, the prospect of the beet-sugar industry in the northern portion of the United States is hopeful.

As a sugar-producing plant, the beet cannot compare with the cane of the tropics, and if it were possible to produce them side by side there could be no competition. There is a curious law developed in the comparison of these sugar-producing plants. When sugar is produced and stored away in the above-ground organs of a plant, it is found to be in the ratio of the light and heat to which the plant is exposed; when found in an under-ground organ it is inversely as the light and heat. Of course this law operates on both sides within the limits of plant-life, that is, the capacity to endure light and heat, or the absence of these. Under the operation of this law, as we recede from the tropics, the cultivation of the sugar-cane becomes less and less profitable, till we reach a point where it is no longer a remunerative crop; so, in passing south from, perhaps, about the fiftieth degree of latitude, on this continent, we traverse the beet-sugar zone till we find a point somewhere about the fortieth degree, where beet culture will cease to be profitable. If we could command an ample territory within the tropics for the production of sugar from the cane, the introduction and fostering of the beet-sugar industry would be of questionable economy. But as our entire territory lies beyond the tropics, cane-sugar becomes an uncertain industry both from degeneration of the cane and the failure of the crop from unfavorable seasons. If we take the production of sugar in Louisiana, before the war disturbed that industry, we shall see how uncertain a crop sugar is in our best latitudes. The production, in hogsheads, in several years, compares thus: In 1834 it was 100,000; in 1835 it fell to 30,000; in 1853 it reached 439,976; but in 1856 there were but 73,000 hogsheads produced. The increasing consumption of sugar, and the comparatively high price maintained, invites competition in this field, and we see no good reason why beet-sugar should not be able to maintain itself in the race.

RYLAND T. BROWN,
Chemist.

HON. FREDERICK WATTS,
Commissioner.

REPORT OF THE BOTANIST.

SIR: I have the pleasure of submitting a report on the present condition of this division and its work during the current year. The position of botanist was vacant from September, 1871, to April of this year, when the present botanist entered upon his duties. Deeming it an important part of the work of this division to give attention to inquiries for information on questions relating to botany, and particularly to practical and economic botany, the investigation of such questions has occupied a considerable amount of the time of the present officer of the division. Many of these questions relate to the nature or qualities of various plants which have attracted the attention of different individuals, sometimes on account of their prevalence as weeds threatening great injury to the labors of the agriculturist; sometimes on account of certain grasses which in some localities are intruding and extending themselves, overpowering and excluding the common species, and which the farmer is at a loss whether to regard as a friend or foe; sometimes in relation to grasses or other plants which have been thought to poison cattle; often seeking information as to the kinds of grasses adapted to cultivation in particular locations; and frequently calling attention to certain plants which furnish strong fiber, and which are thought useful for the manufacture of paper or cordage.

All such questions having a practical bearing upon the agricultural and productive interests of the country have seemed to have a legitimate claim upon the attention of this Department.

Another subject seeming to claim its attention has been the diffusion through the publications of this Department of information regarding the various species of our native forest-trees, and of the kinds which are especially to be recommended for cultivation, particularly by farmers and others living on the western prairies and plains. The material interests of our country are so largely involved in the continued supply and consequently in the continued growth and reproduction of forest-woods, as to justify all reasonable methods of stimulating the interest of our people in this subject.

The botanical collections of the Department have been removed to more commodious quarters in the east wing of the building, and the work of mounting specimens, and their investigation and classification have been prosecuted as rapidly as circumstances would admit.

The following additions to the collections have been made during the year:

Three packages, comprising between 400 and 500 species of the alpine plants of Switzerland, in excellent condition; a contribution from Dr. F. Lagger, Frieburg, Switzerland, received through the Swiss consul-general.

Two packages, embracing about 500 species of the plants of Austria, from Dr. H. Keck, received through the Smithsonian Institution.

Two packages of phenogamous plants, and a very fine collection of mosses, of Middle Europe, from Professor Paul Reinsch, Zweibrucken, Germany, also received through the Smithsonian Institution. The collection of mosses is a very desirable increase to the herbarium of the Department, embracing nearly a complete representation of this order. They have been carefully classified and mounted for convenient reference, and as a large portion of the mosses of this country are identical with those of Europe, the collection will have additional value as a means of determining our own species.

Two small packages of California plants from Mary E. Pulsifer Ames, of Taylorsville, California; very interesting specimens and in excellent condition.

Several packages of Florida plants collected by Mr. Charles F. Powell, Saint John's County, Florida; valuable because from a locality little represented in the herbarium.

Two parcels of the plants of Alabama, from Mr. William Harvey, Mobile, Alabama; also interesting and valuable from their rare occurrence in the herbarium.

A package of interesting western plants from Professor H. H. Babcock, of Chicago, Illinois; and a package, mostly of specimens of a rare species of willow, from the shores of Lake Michigan, near Chicago, presented by Mr. H. A. Warne, of Maywood, Cook County, Illinois.

A set of the plants collected under Mr. Clarence King's exploration of the fortieth parallel, being the types of the descriptions given by Mr. Sereno Watson and others in the fifth volume of the report of said exploration. This collection has great scientific importance, not only from being a very ample representation of the flora of that new region, but from the authentic identification of the species and the general excellence of the specimens. The botanical report of this expedition is one of the most valuable scientific publications of the day, giving as it does a systematic description of the vegetation of the northern and central portions of the great interior basin of the country—information which, so far as published heretofore, had to be sought in the pages of a number of rare and hardly accessible scientific journals and reports.

The set of specimens belonging to the herbarium has been carefully mounted and classified, and will for the present be kept as a special collection for ready reference, and will prove an attractive feature of the herbarium to all persons interested in the peculiar vegetation of that region.

Finally, the botanical collection made the past year by Mr. Coulter, botanist of Professor Hayden's expedition in Montana, has recently been received, and although largely a duplication of the collection of Mr. S. Watson, contains many interesting and valuable additions. Mr. Coulter has displayed more than usual skill in the preparation of his specimens, a circumstance the more to be valued, because for the want of such skill many collections are almost worthless.

The work of classifying the duplicate specimens of plants in the collections of the Department is progressing as rapidly as possible, with a view to their early distribution—first, to such foreign societies and individuals as have already contributed to the herbarium; and, secondly, to such of our own institutions of learning, and scientific bodies, as it may be possible to supply.

During the past year an effort has been made toward a collection of sections of our native trees and large shrubs. Sections of over one hundred different species have been obtained. These sections are about 8 inches in length, and made from trees or limbs not over 6 inches in diameter. They show the bark in its natural state; and it is designed to make longitudinal sections, to show the character of the grain and its appearance when polished. The purpose is, further, to have each specimen accompanied by its seed or fruit, and numbered to correspond with specimens of the leaves and flowers in the herbarium. It is desirable that this effort should be continued until a representation, as complete as possible, of all the forest-trees of the various portions of our country shall be obtained; and it is believed that such a collection,

when properly displayed and conspicuously labeled, will be one of the most instructive and useful features of the botanical museum.

The accompanying botanical papers, suggested by various recent inquiries and investigations, have been prepared with reference to the interest of the topics discussed.

FOREST-TREE CULTURE.

Unquestionably one of the most important questions engaging the attention of the American people is that of forest culture. The demands of our rapidly-growing country have for many years so drawn upon the resources of our native forests, which at one time seemed inexhaustible, that we must now contemplate their early extirpation, and address ourselves to the task of conserving what forests we have remaining, and providing new sources of supply.

Much has been written on this subject, but so difficult is it for us to realize the bearing of remote evils, that comparatively very few farmers or land-owners have yet seriously engaged in the work of replenishing their woodlands. The arguments for this work are strong and numerous, and have been cogently presented by many writers. Many facts have been observed, which appear to show that the presence of forests has much to do with the rain-fall and climate of a country; thus, it is said that the extreme dryness of Spain is due to the absence of trees; that many districts in France have been materially injured by denudation; that Palestine and many other parts of Asia and Northern Africa, which in ancient times were the granaries of the world, are now deserts or infertile regions in consequence of the loss of their forests. It is also stated that a beneficial change in climate and rain-fall has in several instances followed the introduction of trees and plantations in regions that were formerly destitute of them. Thus, it is said that in Lower Egypt, where anciently rain never fell, the introduction and cultivation of extensive plantations have been attended with the fall of a good deal of rain, so that showers are no rarity even at Cairo. It is also affirmed that in New England and other wooded sections the clearing up of forests and cultivation of the soil have had the effect of causing the drying up of many springs and small streams.

There are some who doubt the correctness of these conclusions with respect to the climatic influences of forests; but, as these influences must be of very gradual operation and require observations over a long series of years, the question may be considered open for future inquiry. But, leaving that question out of view, there remain abundant reasons to stimulate every landholder in our vast prairie regions to give practical attention to the subject.

Trees are wanted for their fruits, for their shade and protection from winds, for fuel, for use in building, fencing, and the mechanical arts. Some trees are adapted to one of these purposes and some to another.

The earliest tree-want, which is appreciated by farmers in a new country, is the want of fruit-trees. Even this practical and personal need too often fails to stimulate the farmer to immediate action toward the formation of an orchard. But it is not with reference to the cultivation of fruit-trees that we now design to write.

What kinds of forest-trees shall we attempt to cultivate is a question often asked, and toward the solution of which we propose to offer a few thoughts. In an open-prairie region there is an immediate and urgent want of trees for shelter and wind-breaks. Both man and the domestic animals instinctively seek the grateful shade of trees during the intense

heat of summer, and as instinctively seek their shelter from the fierce winds of winter. The intelligent farmer also knows that it is a question of positive economy, as the absence of suitable shelter must be represented by an increased consumption of food and fuel. Often, too, he finds that without some suitable wind-breaks he is unable successfully to cultivate the best varieties of fruit-trees. He wishes to secure these advantages of shade and shelter at the earliest possible period, and hence he inquires for rapidly-growing trees for cultivation. The great cost of fencing on the prairie leads him to seek some suitable tree or shrub for the growth of hedges. It is true that many experiments in this direction have been attended with failure, but we should not be deterred from continuing our experiments until a suitable hedge-plant is found for every section of country. If the Osage-orange fails, let us try the honey-locust, or some of our native thorn-bushes, crab-apples, wild plums, viburnums, or other shrubs or trees, until we meet with success.

The production of wood for fuel and mechanical uses is an object which, however desirable, has seemed so remote in prospect that it has been almost universally neglected. But even this neglect is to a great extent based upon too general and vague views as to the slowness of tree-growth.

There are several species of trees which, with proper cultivation, will acquire a circumference at the trunk of 8 to 10 inches in five years' growth, and a few acres of such trees would soon furnish a constant supply of desirable fuel to farmers who now have to haul, at great expense of time and labor, a distance of from five to ten miles. Most of the rapidly-growing trees produce soft wood, which is not much esteemed for fuel, but, for summer use, when properly prepared, it must be equal, if not superior, to the corn-cobs which are extensively used for fuel in the Western States. Many western farmers have cultivated their prairie-lands for twenty years, and hauled their fuel from a distance, when, during that time, cottonwood trees of 2 feet diameter, white maple of 18 inches, box-elder of 20 inches, and butternut of 18 inches, might have grown upon their lands with a little labor and care.

The planting and cultivation of hard-wood trees, suitable for building purposes and use in the mechanical arts, is one which has been almost wholly neglected in this country. It is a work which is too commonly regarded as being wholly for the benefit of posterity, and we are slow to realize that we have any duties in that direction. But the necessity of entering upon this work is apparent, for it is not difficult to contemplate the period when our natural forests shall have disappeared under the enormous demands which the progress of our country makes upon them. Some of the trees which, at the present time, seem most deserving of trial for the purposes named, we will briefly notice.

Cottonwood.—In the Western States and Territories the name cottonwood is applied to the *Populus monilifera*. Groves of this tree are common on the streams which traverse the great plains and prairies. Near the base of the Rocky Mountains, however, as in the Platte bottoms near Denver, two other species of poplar are associated with it in the groves, viz: the narrow-leaved cottonwood, (*Populus augustifolia,*) and the balsam poplar, (*Populus balsamifera.*) They are all large trees, of vigorous and rapid growth, and are readily propagated from cuttings. They are particularly recommended for wind-breaks and shelter for more tender and slow-growing trees. A belt of cottonwoods around a young orchard will undoubtedly save many trees from loss by frosts, and contribute to their thrift and productiveness. All the poplars are

diœcious and objectionable for planting in the immediate vicinity of dwellings on account of the abundant cottony down of the seeds, which fills the air after their maturity. This inconvenience can be avoided, however, by propagating from cuttings of the male tree only. Mr. Samuel Preston, of Mount Carroll, Illinois, writes to the Department that for a wind-break he would substitute Lombardy poplar for cottonwood, as being more easily raised from cuttings, bears closer setting, has a more sightly appearance, has no cottony down to fill the air, holds its foliage much longer, and, therefore, is a much better wind-break to an orchard. At the time of his writing, (October 14,) the cottonwoods were bare of leaves, while the Lombardies were full of foliage, and looked as fresh and green as in midsummer.

The maples.—For ornamental culture, for usefulness of wood, and for vigor of growth, there are few trees so worthy of attention as the silver-leaved, or white, and the red, or swamp maple. In the Western States the red maple is comparatively rare. The white helps diversify the forest growth on the bottom-lands of most of the western rivers, and is largely planted as a shade-tree in the cities. A serious objection to its cultivation is, that its long, slim branches are liable to be broken by storms of sleet and snow. This difficulty could be obviated by a judicious shortening in of the branches. In some parts of the West it has suffered severely from the ravages of a borer, which penetrates the trunk. The red maple is more compact and somewhat less rapid in its growth, but is deserving of large planting.

Hard maple or sugar maple.—For beauty of form, for its close and dense foliage, for the value of its wood, and of its saccharine juice, no cultivator should neglect the sugar maple. In the whole family of maples, whether native or foreign, this species is without a peer. It is a little shy of transplanting, and for the first few years is of slow growth, but when it is established it is worth many times its cost. Several foreign species of maple are cultivated for ornament and shade in the eastern cities, but they present no advantage over our native ones.

Box-elder, (*Negundo aceroides.*)—This tree rivals the cottonwood in rapidity of growth, and is deserving of particular attention, combining not only the qualities of rapid growth, of hardiness, of handsome foliage, and a good quality of wood, but having also great promise as a sugar-producing tree. Some investigations made in Illinois, with reference to its value for sugar, are reported to decide: 1st. That it produces more sap than the sugar maple of equal size, half a gallon per day being obtained from a small tree of 3½ inches in diameter, and five years old. 2d. That the sap is richer in sugar, the yield of dry sugar averaging 2.8 per cent. of the weight of the sap. 3d. That the sugar produced is in general whiter than that from sugar maple treated in the same way. These facts should recommend this tree to the early attention of all tree-planters, especially in prairie regions.

Ailanthus.—The ailanthus appears to be one of the most promising trees for cultivation in the West. It thrives well even on hard and stony soils. It is a native of China, but has for many years been cultivated in Europe and in this country. It approaches in botanical affinities nearer to the wafer-ash or hop-tree (*Ptelea trifoliata*) than to any other tree of this country. It produces flowers of two kinds, generally on different trees. The male flowers are produced in large panicles, and are of a greenish-yellow color, and very disagreeable odor, which circumstance has made it quite unpopular as a shade-tree in cities. This, however, would not be a serious objection to its cultivation as a forest-tree. The wood is hard and fine-grained, and well adapted to cabinet-work.

It is also good for fuel. In France and Southern Europe it grows to a large size on chalky soils where few other trees would live. It has been largely planted on the plains of Southern Russia, to fix the loose, blowing sands. North of latitude 40° it will probably be too tender for profitable culture. It is easily propagated, either from seeds, suckers, or root-cuttings. It was introduced into this country under the name of "tree of heaven," and is indeed a beautiful tree when in full foliage.

Ash.—We have five or six native species of ash, all of which are ornamental and useful trees, but two species, the white and the blue, are especially valuable, and should be among the kinds planted by every cultivator. The timber of the ash is adapted to a great variety of uses, particularly in the manufacture of farming-tools. On account of the great demand for this timber for agricultural implements, for carriages, and furniture, it is becoming scarce, and its cultivation promises to be very remunerative at an early day. The white ash becomes one of our largest forest-trees, attaining the height of 70 or 80 feet, with sometimes a diameter of 3 feet at the base. The wood is white, and remarkable for its toughness and elasticity. For these qualities it is used for hoops, pitchfork and rake handles, and for wagon-shafts. Emerson relates that an ash-tree in Granville, Massachusetts, was rived into 3,000 rake-handles. It was 4½ feet in diameter, and had a shaft of 70 feet without a limb. The white ash requires a deep, moist soil, for its greatest perfection. Most prairie soils are well adapted to its growth. It bears transplanting well, and is remarkably exempt from the attacks of insects. The blue ash occurs in the bottom-lands of the Western States. It may be readily distinguished by the young shoots being square or sharply four-sided. The wood is said to be more durable even than that of the white ash, especially when exposed to the weather, as for fence-posts, stakes, and rails. This species has a southern, and the white ash a northern range. The seed of either may be sown in the fall, thinly covered with earth, and lightly mulched with straw, or it may be sown in the spring, after being mixed with moist sand, and exposed for a few days to a warm sun.

The walnuts.—The black walnut is a timber of so much importance in cabinet-work, and is becoming so scarce by the constantly-increasing demand, that no tree-cultivator should neglect to give it a place in his plantation. The tree begins to bear fruit at an early age, and the nuts, which resemble those of the English walnut, are much esteemed by most persons.

The white walnut, or butternut, furnishes a wood of similar texture, light brown, fine-grained, and easily worked, but not so ornamental as the preceding. The walnuts do not transplant well, and, therefore, the nuts should be planted where the trees are to remain. From the seed they grow vigorously, especially the white walnut, which almost equals the soft maple in thrift.

The American chestnut.—This is one of the finest in appearance, and one of the most useful, both for the value of its timber, and for its valuable fruit, of our native trees. The difficulty of transplanting the young trees has hindered its cultivation. It is found chiefly in hilly and mountainous districts, and for successful cultivation should at least have a dry, well-drained subsoil. Mr. Preston, of Mount Carroll, Illinois, says:

> It has been generally supposed that the chestnut could not be successfully raised upon our prairies. But my experience, and that of others, proves it to be a mistake. I have them seventeen years old, and bearing nuts, and some of the trees are 12 inches in diameter. They grow faster than the butternut, which I also have of about the same age. I have never succeeded in transplanting the chestnut, while I have transplanted the butternut, with a loss not to exceed 2 per cent.

The elms.—Of our elms, the white and the red are the most important. For an ornamental tree for parks, lawns, and streets, they have a national reputation. They are hardy, grow with tolerable rapidity, and are readily transplanted at almost any age. The wood of the white elm is rather inferior in quality; that of the red is stronger and more durable, and is much used for the manufacture of wagon-hubs, carriage-wheels, &c.

The white willow.—Notwithstanding the prejudice which exists against this tree, on account of the extravagant representations made of it a few years ago, as a hedge-plant, it deserves attention from its rapid growth, as well adapted for wind-breaks and screens. It may be planted in low grounds which are unsuited for most trees, and will thrive best in such situations. Its light and graceful foliage affords an excellent contrast with most other deciduous trees, and in places where fuel is scarce, it is deserving of cultivation for an early and abundant production of wood.

Evergreens.—By evergreens is commonly understood the family of coniferous trees, because in northern latitudes these are the only trees which retain their foliage throughout the year. The deciduous trees give us shade and shelter during the summer; but in our prairie regions, during the coldest half of the year, they are leafless and afford only partial protection from the fierce blasts of winter. This consideration alone should recommend the cultivation of evergreens to every dweller upon prairie soil, for not only is the comfort of man and beast concerned, but also practical economy, as it is well known that the abstraction of animal heat by cold winds must be counterbalanced by an increased supply of food. But the fact that these coniferous trees furnish our most valuable building-material, that our native supply of them is rapidly diminishing, and the market value advancing, affords strong and urgent argument for the attention of tree-growers.

Pines.—The White, Austrian, and Scotch pines are considered the best for general cultivation. Mr. Bryant says of the white pine: "No one of our native forest-trees is more generally useful, and no one better merits careful preservation and extensive culture. As an ornamental tree, it is surpassed by few, if any, of the genus. Its foliage is soft, its hue agreeable, and the whole appearance of the tree graceful."

The Scotch pine is one of the most rapidly growing species, and succeeds in very variable soils, being perfectly hardy, even in the most northern parts of the country. It bears transplanting with more facility, perhaps, than any other species. Its thick, dense foliage adapts it well for screens or belts for the protection of orchards. On account of its rapid growth, its valuable wood, its hardiness, and its adaptability to different soils, it is strongly recommended for cultivation. The Austrian pine has much resemblance to the Scotch, having longer leaves, of a darker color. It grows vigorously, and from its stiffness and strength resists the most violent winds, and does not suffer under the heavy accumulations of sleet and ice, which sometimes greatly injure more slender species. It has been extensively planted for ornamental purposes, and although rigid and ungraceful in habit, its dense and dark foliage in winter renders it very pleasant to look upon.

Spruce or fir.—The white and black spruces, the Norway spruce, and the hemlock or hemlock-spruce, are the most important species of this genus, *Abies*. The Norway spruce in particular has been highly recommended by several western horticultural societies as the most suitable tree for belts for the protection of orchards. It is perfectly hardy, bears transplanting, is vigorous in growth, and adapted to all common soils.

The white and the black spruces are among the most valuable ornamental evergreens, and their presence in the vicinity of the farm-house or dwelling is at once an evidence of taste, and adds materially, not only to the market-value of a place, but presents agreeable objects for the eye, and relieves the dreariness of the winter landscape.

Among ornamental evergreens, perhaps none is more deserving of a place than the hemlock. Its delicate light-green and silvery foliage, and slender, drooping, graceful branches, form a pleasing contrast with the stiffer and more rigid pines and spruces. Perhaps, on account of its commonness in the Northern and Eastern States, it has been neglected as an ornamental tree. Mr. Meehan says of it that it would be no exaggeration to pronounce it the most beautiful evergreen in cultivation. It has been recommended as a screen or ornamental hedge, but for this purpose there is probably no evergreen equal to the arbor-vitæ. This bears close planting, may be pruned into any desired shape, and forms a dense, compact wall of the deepest green. The Siberian and Chinese arbor-vitas are considerably cultivated, and may, perhaps, suit some localities better than the American.

The larch.—The larch, although not an evergreen, is a coniferous tree, possessing the same general characters of structure and fructification as those we have mentioned. The American and the European are the two species which are known in cultivation. The European larch has of late years been very highly, perhaps extravagantly, recommended for general cultivation as a timber-tree on the western prairies. It has, indeed, many valuable qualities, being a very rapid grower, possessing a pleasing symmetry of form, and furnishing a wood of great value and adapted to a great variety of uses. Extensive plantations of it have been formed in Scotland, which have proved highly successful. The plantations of the Duke of Athol, in that country, are everywhere famous, and have stimulated to extensive planting of this tree in other countries. It has been here tried sufficiently to prove its value as a rapid, vigorous grower, hardy and beautiful, but the wood grown here has not been sufficiently tested to fully decide on its merits. Recently, Professor Matthews, of the Iowa Agricultural College, has thrown out some doubts about the durability of the wood grown upon the western prairies. It seems highly probable that the quality of the timber is affected more or less by soil and climate. Loudon says that "a certain elevation of surface, coolness of climate, and inferiority of soil, are absolutely necessary to produce the timber in perfection." On broken hills, bluffs, and slopes it can probably be grown with great profit. The American larch very closely resembles the European, having smaller cones and shorter and paler leaves. Its natural situation is in cold swamps in the northern portions of the United States, where it is known as tamarack or hackmatack, but it seems to succeed well on high and dry soils. Many contradictory statements have been made as to the value of the timber, some considering it even superior to the European species, others accounting it of little value. Mr. Lapham, of Wisconsin, says: "Those who desire to make plantations of the larch should take into consideration the character of the land to be planted; if it be wet, then the American larch should be chosen. It is a tall, slender grower, with coarse-grained, durable, and valuable wood, wherever light, straight timber, such as hoop-poles, is required."

The variety of our forest-trees is very great, and undoubtedly there are many other kinds which are equally entitled to cultivation with those we have named. Forest-culture is yet in its infancy here, and we

PLATE IV.

THE JUTE PLANT CORCHORUS.

should go on experimenting and observing until we learn what are the most profitable and useful kinds.

THE JUTE-PLANT, (CORCHORUS.)

PLATE 2.

Fig. 1. Corchorus capsularis, the jute-plant.
2. The matured pod.
3. The expanded flower.
4. Corchorus olitorius, or Jew's mallow.

Perhaps no vegetable product has been more rapidly introduced into general cultivation and has acquired greater importance during the past thirty years than the jute-plant.

An article in the monthly report of the Department for November and December gives some very interesting items of its successful cultivation in many of the Southern States, from seed distributed by the Department, and as its culture seems likely to be still more extended, some information as to the nature and qualities of the plant will no doubt be acceptable.

The material for the account which we here present has been mostly obtained from "Science Gossip."

Jute is a fiber obtained from the inner bark of two species of plants belonging to the natural order *Tiliaceæ*, an order which is represented in our country by the linden or bass tree. It is from the European linn that the material well known to horticulturists as "bast matting" is obtained. The two common jute-plants are *Corchorus capsularis* and *Corchorus olitorius*, the former being generally considered the more valuable. The plants are annuals, growing from 4 to 12 feet high, according to the quality of the soil and the location, the stems at the base becoming an inch or more in diameter. The leaves are alternate, lanceolate in outline, toothed on the margin, with the lower pair of teeth prolonged into a slender thread. The flowers are small, half to three-quarters of an inch in diameter, yellow in color, having five petals and a large number of small stamens.

The fruit consists of a capsule, which in *C. capsularis* is nearly round, and in *C. olitorius* cylindrical and narrow. These capsules contain many small seeds. It is sown at different periods, according to the climate and variety, usually in April or May, and it flowers in July or August, when it is ready to be cut for the fiber. In Louisiana two crops have been obtained in one season. If cut at the first commencement of blossoming, the plants are more easily cut, and furnish a finer fiber than if left to mature. It is said that in India the stems or stalks of the jute are of almost equal value with the fibrous portion. They are beautiful white and straight stems, of a light, brittle wood, somewhat like willow switches, and have a multitude of uses among the natives, such as for the manufacture of gunpowder and fireworks, for the making of fences and inclosures, for pea-brush, and for the construction of those acres of basket-work which the traveler remarks near every native village. The thick and coarse butts of the older plants are cut off for about 9 inches. These butts are sold to paper-makers, and wrought up into coarse, thick fabrics.

The jute fiber, as prepared for the market, has much resemblance to that of hemp, but is softer and more glossy, and, under the microscope, more transparent and slender, and apparently with thinner cell-walls.

The principal employment of jute in India is for the manufacture of

gunny-bags. These are the common, coarse bags in which Indian produce is sent to market. They are also extensively used in the shipment of agricultural products in this country. The manufacture of these bags is an industry which pervades all classes in Lower Bengal, and penetrates into every household. Men, women, and children find occupation therein. Boatmen in their spare moments, husbandmen, and domestic servants, everybody, in fact, pass their leisure moments, distaff in hand, spinning gunny-twist. All the finer and long-stapled jute is reserved for the export trade, while the short staple serves for the local manufacture of gunny-bags. The export of jute from India has rapidly increased during the past twenty years, and now reaches nearly 3,000,000 bales.

WHAT IS CUNDURANGO?

PLATE 1. *Cundurango* (*Schubertia.*)

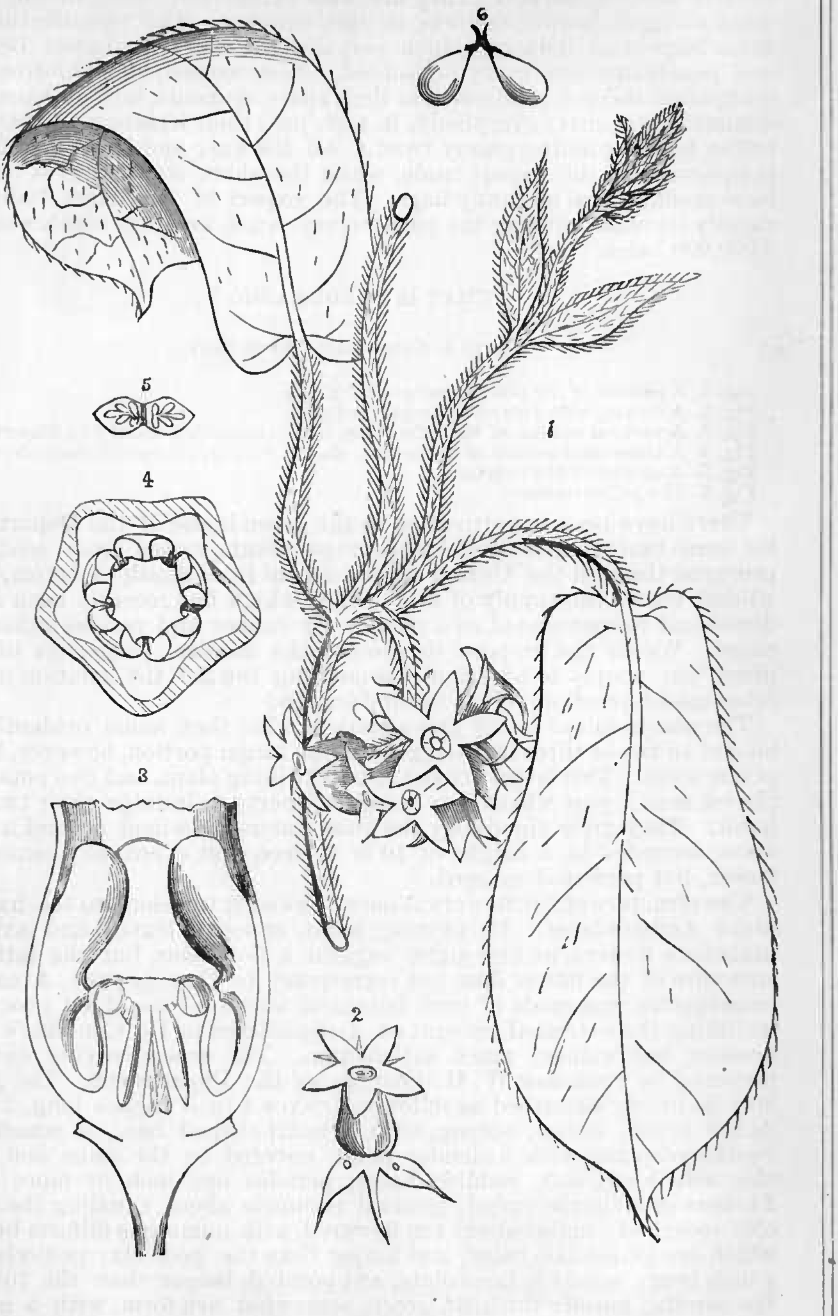
Fig. 1. A portion of the plant, nearly natural size.
Fig. 2. A flower, with two of the sepals reflexed.
Fig. 3. A vertical section of the tube of the corolla magnified about five diameters.
Fig. 4. A transverse section of the corolla, showing the gynostegium from above.
Fig. 5. A section of the ovaries.
Fig. 6. The pollen masses.

There have been in cultivation in the green-house of the Department for some two years several cundurango plants, raised from seed, and procured through the United States consul from South America, from whence comes the supply of that article which has recently been introduced and recommended as a remedy for cancer and various other diseases. We do not propose to discuss the medical properties of this plant, but simply to contribute something toward the solution of the often-asked question, What is cundurango?

The plants raised in the green-house under that name evidently belonged to two or three distinct genera, the larger portion, however, being of one kind. This latter proved to be a twining plant, and two pots were placed near a post where they were at liberty to indulge their twining habit. They grew vigorously the past summer, twined around a *Bauhinia*, ascended to a height of 10 or 12 feet, and eventually came into flower, but perfected no seed.

The structure of the flowers at once showed it to belong to the natural order *Asclepiadaceæ*. Its twining habit, opposite leaves, and axillary umbellate flowers, at first sight suggest a *Gonolobus*, but the intimate structure of the flower does not correspond to that genus. A careful examination was made of such botanical works as could be procured, including the extended account of *Asclepiadaceæ* in De Candolle's Prodromus, but without much satisfaction. The accompanying cut was prepared by Professor W. H. Seaman, of the Department. The plant may be briefly described as follows: Leaves 4 to 5 inches long, 2 to 3 inches broad, entire, oblong, with a heart-shaped base, or sometimes cordate-obovate, with a slender point, covered on the veins and petioles with long, soft, reddish hairs; petioles one inch or more long. Flowers in a simple umbel; general peduncle about equaling the petioles, recurved; umbel about ten-flowered, with numerous filiform bracts, which are glandular, hairy, and longer than the pedicels; pedicels $\frac{1}{3}$ to $\frac{1}{2}$ inch long; sepals 5, lanceolate, awl-pointed, longer than the tube of the corolla; corolla thickish, green, somewhat urn-form, with a globular base, a little constricted at the throat, surmounted with five ovate, spreading, slightly-reflexed lobes. Within the tube of the corolla are five

PLATE V.



THE CUNDURANGO PLANT.

fleshy bodies or scales, attached to the tube and alternate with its lobes, constituting what is called the corona. These seem to be extensions or reflexions of the filaments, which are united to the central style, and which, thus united, compose the peculiar column distinguishing the plants of this order. Mr. Sereno Watson, of Cambridge, was also able to distinguish a second row of scales attached near the base of the first, and forming thus a double corona. The older parts of the stem are covered with a peculiar corky epidermis, deeply furrowed by irregular cracks and fissures. It is to be expected that the remaining cundurango plants will mature the coming season, so that their botanical relationships may be ascertained.

CULTIVATION OF THE CINCHONA.

The great medicinal importance of the cinchona-barks, their high price, and the prospective exhaustion of the natural supply, have led during the past ten or twelve years to attempts in many places to cultivate the cinchona tree. The principal of these attempts, in point of magnitude, are those of British India, Ceylon, and Java, but attempts have also been made with more or less success in Jamaica, Guadaloupe, in Martinique, in Algeria, at Rio Janeiro, Saint Helena, at Melbourne, in Australia, and in the Caucasus.

The earliest experiments in this direction were made by the Dutch, in Java, who commenced a plantation in 1854, but from various causes their attempts were at first unsuccessful. The principal difficulties were the selection and cultivation of varieties which were poor in the amount of quinine they naturally afforded, and errors in cultivation with respect to soil, elevation, and temperature. These errors have of late years been corrected, and an account of the state of the cultivation of the cinchona in Java, in 1868, shows the following number of trees of different varieties then in cultivation: Of *Cinchona calisaya*, 509,582; *Cinchona succirubra*, 27,578; *Cinchona condaminea*, 28,874; *Cinchona lancifolia*, 573; *Cinchona micrantha*, 386.

British East Indian experiments.—In 1859–'60 the British government commenced their experiments in the culture of the cinchona-plants in the East Indies. These experiments were intrusted to skillful scientific gentlemen, and every known means employed to give them a fair and judicious trial. The result of these experiments has been highly satisfactory. The propagation of the trees has been greatly extended, so that the number now in plantations exceeds a million.

The first and principal plantation was that of Octacamund, in the Neilgherry Mountains, which are in about latitude 11° north and longitude 77° east of Greenwich.

These mountains rise 4,000 to 5,000 feet from an undulating plain, which is 2,000 to 3,000 feet above the sea-level. The amount of rainfall during the year is about 70 inches. We have no information at hand of the range of temperature during the year.

The second plantation is that of Darjhieling, in the Sikhim district, at the base of the Himalaya Mountains, in latitude 27° north, and at elevations varying from 1,800 to 4,000 feet above the sea.

Next in importance are the plantations in Ceylon, at an elevation of 6,000 feet above the sea, with a moist climate, and an annual temperature of about 59°, presenting in these respects great correspondence to the natural location of the cinchona trees in South America.

The result of these different trials in India has been quite satisfactory,

and for several years past a small amount of bark from the cultivated trees has been sold in the London market at remunerative prices.

A recent English publication, called the "Quinology of the East India Plantations, by John Eliot Howard," give much information regarding the different medicinal alkaloids contained in different varieties of the bark, and the effect of location, climate, and cultivation upon those products, and although certain general statements are made respecting altitude and temperature, yet no such detailed account of these points is given as to render the statements perfectly satisfactory to readers in this country who are anxiously looking for information bearing on the question of the cinchona cultivation in the United States.

The work enters learnedly and fully into the chemical analysis of the different parts of the cinchona tree, as the root, the wood, the sap, the leaves, and the bark, and seems satisfactorily to determine the origin and production of the quinine elements. We have availed ourselves of such information in the work mentioned as we have thought might be of general interest.

Elevation above the sea-level.—"Recent observations on this point," says Mr. Howard, "may save the apparently useless attempt to cultivate these plants at a level below 4,000 feet above the ocean. Bark of *Cinchona succirubra*, grown in the Wynaad at an elevation probably not exceeding 2,400 feet, was thinner than that of Neilgherry growth, and gave but 0.5 per cent. of sulphate of quinine, and 2.9 per cent. of cinchonidine, showing that quinine is formed in much less quantities at low elevations."

We will here remark that the cinchona barks contain several alkaloids, having very different medicinal values. The principal of these alkaloids are quinine, cinchonidine, and cinchonine. They form a chemical series differing principally in the proportion of oxygen which they contain, and while the sum total of these products may not differ greatly in barks grown at different elevations, yet their *relative* quantity may vary greatly, and that fact is a matter of great importance in a medicinal point of view. It appears from the result of trials that, for medicinal purposes, the quinine and cinchonidine are of nearly equal value, while the other alkaloids are comparatively of little worth. Of course, therefore, that condition of elevation and mean temperature which results in the production of the greatest proportion of quinine and cinchonidine will be an important consideration in the culture of the cinchona trees; practically, indeed, the question of profitable culture hinges upon the amount of *crystallizable* quinine which can be obtained from a given quality of bark. It is found also that the amount of the valuable alkaloids is affected by the amount of sunshine and shade afforded the trees. The bark countries of the Andes are situated in a region of perpetual trade-winds, which bring abundant rains and fogs during the greater part of the year to interrupt the sunshine. But the climate of the mountain-ranges of Southern India differs from that of the bark region of South America in having six months of unclouded sunshine, when the singular dryness of the atmosphere robs the rays of none of their heating power. It appears that in India the elevation of 6,000 to 7,000 feet is most favorable to the production of quinine in the *Cinchona succirubra*, and that above 7,000 feet the product diminishes. *Cinchona succirubra*, *Peruviana*, and *micrantha* thrive at elevations ranging from 4,000 to 6,000 feet, while *C. officinalis*, *Bonplandiana*, and *crespilla* continue to grow more vigorously on the Doolabetta plantations at elevations varying from 7,000 to 8,500 feet. The crown barks are

adapted to the higher elevation and the red barks to a lower. This corresponds to what we know of their growth in their native localities.

Mr. Howard says, "My own belief is, that success, though not to the fullest possible extent, has been assured by the steps already taken in the acclimatization of the *Cinchona* in India; but it will not be well to overlook the fact that in Java some disappointment has been felt, and it is only by avoiding errors in the choice of species, and by carefully selecting the best situations and modes of culture, that individual planters in other parts of the world will see their efforts crowned with remunerative results."

With respect to the cultivation of the cinchonas within the limits of the United States, considerable diversity of opinion has been expressed. The great variations of temperature, to which our climate is subject, seem to offer the strongest objection. The occurrence of frost is injurious, if not fatal, to the cinchona, and this fact excludes the greater portion of our country from any probability of its successful cultivation. It has been thought that some portions of Texas and California will furnish the climatic conditions requisite for the growth of this valuable tree.

Thermometric observations, continued for many years at San Diego, in California, show a mean temperature through the year of about 62°, while the lowest temperature reached during the year is about 33°. The mean temperature of spring is about 60°; of summer, 68°; of autumn, 63°; and of winter, 54°. Only a series of carefully-conducted experiments, with reference to this matter, can fully determine the capabilities of our climate for the cultivation of these trees.

EFFECT OF CHANGE OF CLIMATE UPON THE BARK-PRODUCTS IN INDIA.

Mr. Howard says it was at first a somewhat doubtful and anxious inquiry whether the product in alkaloids might not be deteriorated or altered by the change of climate to which the plants were subjected. In order to determine this point, a chemical analysis was made—first, of original bark from the mountains of Peru, of which ripened seeds were also obtained. This analysis resulted as follows:

Oxalate of quinine	1.87
Cinchonidine	1.20
Cinchonine	.04
Total	3.11

Plants grown in England, under glass, from seeds of the preceding, gave as follows:

Sulphate of quinine	1.36
Cinchonidine	.57
Cinchonine, merely a trace.	
Total	1.93

The plant from which this analysis was made was afterward sent to India. It was about 6 feet high, and although suffering in the first instance from its change of location, was so entirely restored that it yielded many thousand young plants.

After becoming fully acclimated, the bark of this tree was subsequently sent to England for analysis, and showed a considerable increase of the quinine products.

Another analysis was made of bark, the product of trees descended from the last, and grown wholly in India, with the following result:

Sulphate of quinine	1.75
Sulphate of cinchonidine	1.50
Cinchonine	.08
Total	3.33

It thus appears that in the third generation the plants had acquired such an acclimatization that the quinine product was almost exactly equal to that of the first generation grown in its native habitat, on the mountains of Peru. Subsequent experiments in cultivation seem to show that not only can the same amount of alkaloids be obtained from trees of Indian growth, but that in some species, at least, a decided increase can be procured, especially through the system of mossing the bark.

Mossing the bark.—This is one of the most important discoveries with regard to cinchona culture. Mr. McIvor tells us that his idea of artificially applying moss to the bark of our cinchona plants originated from the fact that the best cinchona bark of commerce is invariably overgrown with moss. Hence the supposition that moss preserved the alkaloids from oxidation or deterioration, which they apparently undergo when the bark is long exposed to the full action of light. Mr. McIvor's plan is thus described: In removing the strip of bark, two parallel cuts should be made down the stem at the distance apart of the intended width of the strip of bark; the bark is then raised from the sides of the cut and drawn off, beginning from the bottom, care being taken not to press or injure the sappy matter (cambium) left upon the trunk of the tree. This cambium, or sappy matter, immediately granulates on the removal of the bark, and, being covered, forms a new bark, which maintains the circulation undisturbed. In this way successive crops of bark are obtained from the same trees, and thus is avoided that wholesale destruction of trees which takes place in the native habitat of the cinchonas, by the practice of felling the trees to obtain the bark.

Renewal of the bark.—It will be a matter of surprise to some that a tree may be stripped of its bark on the main trunk without the entire ruin of the tree. But it is known that this work may be performed under certain circumstances with impunity. It must be performed when the bark is readily separable on account of the descent of the juices, of which the new cambium layer is made. And the denuded body of the tree must be kept moist, shielded from exposure to the sun, and from heavy rains, which would injure or destroy the vital changes to be effected in the new deposit. With these precautions, it has been claimed that even fruit-trees may be stripped of their bark with safety.

Source of the renewed bark.—This important physiological question is discussed at length by Mr. Howard. Our ideas on this subject are generally formed from the results which usually follow when incisions with an axe are made into the body of a tree. Here the wound is closed up generally by the gradual extension of new material from the upper surface of the cut. But in these cases there is usually more or less removal of the wood with the bark, and the surface being left exposed to the sunlight, is quickly dried up and rendered incapable of vital action. Many years ago the attention of the French vegetable physiologists was directed to this subject. In 1852, M. Trecul submitted to the Academy of Sciences the trunk of a black-gum tree, (*Nyssa*,) brought from Louisiana, where it had been protected by the shade of a damp, marshy forest from the direct action of the sun. It had been deprived of its bark for the space of sixteen or seventeen inches all around the stem, and nevertheless not only continued to grow, but bore leaves and fruit.

Fresh layers had begun to form, not only in connection with the bark both above and below the decorticated portion, but also on the surface of the denuded wood. Messrs. Duhamel, Meyen, and others have asserted that when a portion of the wood of the trunk is laid bare, and the decorticated portion is preserved from desiccation and from atmospheric influences, there are seen exuding from the surface of the wood gelatinous protuberances, *mamelons*, as they were named by Duhamel, or *gelatinous drops*, as they were called by Meyen. These productions, after they have become multiplied in number, and extended nearer to each other, at length become hardened and organized as fresh bark. Duhamel looked upon this as an organizable liquid. Meyen noticed that this exudation, from the first moment when it showed itself at the extremity of the medullary rays, was composed of a very delicate cellular tissue, the cells of which contained a gummy mucilage; but M. Trecul first clearly showed that these new productions are from the beginning composed of cells, and that these cells, which have a gelatinous appearance, are produced by those of the *generative layer*, which remains on the surface after the bark has been removed.

Function of the medullary rays.—What is the function of the medullary rays has long been an agitated question, and is one which may receive some elucidation from the facts and observations here stated. It is well known that these rays are but extensions of the cellular tissue of which the pith is composed, and that they are compressed into thin plates by the intrusion of masses of woody fiber. The heart-wood of an old tree becomes filled with earthy deposits, ceases to take part in the circulation, and may perish, as it frequently does in trees with a rotten heart, without impairing the general vitality of the tree, the circulation being carried on through the new outer layers. These medullary rays are extended laterally by cell-multiplication into every new layer of wood. Is it not probable that they retain their vitality only at or near the surface, and that their multiplication at that point creates a net-work of cellular tissue into and through which the descending products of vegetation are diffused? What is the law which presides over the organization of different tissues is as inexplicable in the vegetable as in the animal system. The medullary rays are identical in nature with the growing point of buds, and their function seems to be the same, viz, the multiplication of cells for the formation of cellular tissue, which is the groundwork of all vegetable growth. In the case of the denuded wood, exposed to the action of the air and the sun, the medullary rays are dried up and destroyed; but if they are kept moist, and shielded from the sun, they rapidly engage in their special work, and reparation or renewal of the bark is effected, and the formation of other tissues follows as a natural consequence.

The cambium.—"If we examine the stem of a tree in winter or during the period of complete rest, we find between the last-formed layer of wood and the bark a layer of cellular tissue. At the first return of spring the nourishing sap flows into this generative layer, and swells up its component parts. This zone is composed of tolerably regular cellular tissue. Insensibly, by the progress of vegetation, a large number of these cells become longer, their cell-walls thicken, and soon present all the characters of fibrous tissue. Coincidently with this transformation a certain number of cells dispersed in the midst of the others increase in diameter and length, their cell-walls present transparent punctures, and they become converted into radiated or punctated vessels. These vessels and tubes form bundles separated by a cellular

tissue which keeps its primitive form, and after some time all the interior of the generative zone (cambium) becomes organized into a new woody layer, which adheres to and forms part of the previously formed wood. At the same time, in that portion of the generative layer which is in contact with the bark, a certain number of cells undergo similar transformations, assimilating them to, and preparing them to form, a new portion of bark."

Source of the alkaloids in the renewed bark.—Mr. Howard prosecuted an extended series of experiments to ascertain the source of the alkaloids formed in the bark. In summing up he says: "We have thus far traced the deposits of the ascending sap in its course from the roots, through the wood, to the leaves, and we do not find any reason to look upon either the wood of the roots, or of the stem, or of the more succulent and recently-formed portions of the ligneous structure as the seat of the formation of the alkaloids. In all these parts the proportion of alkaloid is insignificant when compared with that of the bark. In the outside portion of the stem-wood we find rather less alkaloid and rather more kinoric acid than in the center-wood, and there is a smaller amount of resin, but a perhaps greater proportion of wax associated with the alkaloids; they exist in both in a somewhat greater degree of purity than in the root. When we come to the leaves we find almost the same proportion of alkaloid as in the wood, but this amount not increased, as would surely be the case if the leaves were the seat of its formation. In tracing the course of the nourishing or descending sap we find the alkaloids increasing *greatly*, not less than ten or twenty fold, often much more in their relative amount in the liber, as compared with the parts we have passed under review; and what is also very important, they are in a state of much greater purity, as if freshly formed. In the cellular envelope there is again a considerable increase, to the extent of 100 or 150 per cent. on the contents of the liber, and the alkaloids, or at least quinine and cinchonidine appear to be especially stored up in this cellular envelope, but this in connection with various substances difficult to separate from them. In the *mossed barks* the alkaloids seem to exist in the cellular envelope in a state of greater purity. The review of the whole seems to point to the *bark* as the seat of the formation of the alkaloids."

Modus operandi.—The mode of operation by which the alkaloids are developed in the bark was made the subject of many experiments and of very close observation by Mr. Howard, but it is acknowledged to be one of those vital actions which neither the microscope nor the laboratory has yet been able to expose. There seems to be some unexplained relation between the laticiferous ducts of the liber and the development of the alkaloids, a large development of these ducts being always associated with a poverty of the alkaloids; and, in proportion as the alkaloids become more abundantly developed, the laticiferous ducts disappear or become much restricted in their size and relative importance.

Conclusions.—The following are some of the conclusions to which, in summing up his experiments, Mr. Howard arrives:

First. The permanence of the characteristics of species, as far as ascertained by the present investigation. After all the changes and the varied treatment of the cinchona succirubra, it appears to remain exactly the same in all material points as in South America.

Second. The cultivation of the chinchona in India promises complete success, but to insure this, great attention must be paid to the choice of species.

Third. That Mr. McIvor's plan of mossing the bark is an important discovery in the direction of intelligent culture.

Fourth. That the place of deposit of the alkaloids is in the cellular tissue of the bark, beginning from the cambium outward.

Fifth. That the sources whence the materials are drawn for this elaboration are at once the nourishing sap descending in its usual course, and a *lateral conveyance through the medullary rays* of part of the deposit of the mother substance in the wood.

Sixth. That the *chlorophyllion* respiration does not favor, but that the general respiration does favor, the production of alkaloids.

Seventh. That the laticiferous ducts dwindle and disappear coincidentally with the formation of alkaloids.

THE BLACK KNOT OF PLUM AND CHERRY TREES.

The following extracts are from a paper by Professor C. H. Peck, of Albany, New York. The importance of the subject, and the clear and thorough investigation which Professor Peck has given it, are sufficient argument for its introduction:

Attention has been given for some time past, by one of your committee, to the investigation of the cause and nature of the so-called *black-knot*, that terrible pest of the plum-trees and cherry-trees of our country. Various and conflicting opinions have been entertained respecting its character, but all agree in pronouncing it a very injurious and even fatal visitant to the trees it affects, and all who have proposed any remedy, so far as we are aware, have recommended the most thorough use of the knife.

It is a noticeable fact that most of the authors who have written upon this subject, wrote as entomologists, not as botanists, and any errors they may have fallen into should, therefore, be looked upon with leniency. One author even apologizes to the botanists for "stealing their thunder," as he expresses it, pleading as his excuse that he had at first mistaken the black-knot for an insect gall. We think the botanists scarcely deserve an apology, since they have so persistently neglected to investigate a matter of so much importance.

What is black-knot? To this question Dr. Fitch, entomologist of the New York State Agricultural Society, answers: "It is a large, irregular, black, wart-like excrescence which grows upon the limbs of plum and cherry trees, causing the death of all the branch above it, and extending down the limb farther and farther every year till the whole branch is destroyed, other limbs at the same time becoming affected in the same manner, and also the limbs of other trees in the vicinity. If it is neglected it in a few years kills the tree."

The late lamented B. D. Walsh, entomologist of the State of Illinois, thus defines it: "It is a black, puffy, irregular swelling on the twigs and smaller limbs of plum and cherry trees, and, in one instance that came under my observation, of peach-trees, making its first appearance in the latitude of New York early in June, and attaining its full growth by the end of July. Usually a tree that is attacked in this manner is affected worse and worse every year until it is finally killed, and, where one tree of a group is affected, the malady usually spreads to them all in process of time."

According to our observations the death of the branch above the excrescence is not always produced by the first attack. In such cases the malady extends upward as well as downward. The time of the first appearance of the excrescence is in late autumn, although the external development of the fungus is not manifest until the following May. We have never found it on peach-trees.

Let us now see what is written concerning the origin of black-knot. Schweinitz, the botanist, who wrote the original description of *Sphæria morbosa*, the fungus that develops itself on the excrescence, seems to have been in some doubt concerning the origin of the tumor. In his description be uses these words: "*Haec massa num sit effectus ictuum Cynipis nescimus, videmus tamen hic illic exesum foramen, forte e profundo progessæ.*" At a later day, in writing upon this same subject in his Synopsis of North American Fungi, he says: "*Paucis annis post, fere omnes destructi sunt, combinato furore hujus fungi et Cynipis.*" And again he says: "*Et in his omnibus Cynipis fungusque incepiunt sævire.*" Thus he constantly associates the insects which he calls cynips with the fungus, without definitely assigning the honor or dishonor of the mischief to either. We find the following in *Harris's Treatise on Injurious Insects*: "The plum, still more than the cherry-tree, is subject to a disease of the small limbs that shows itself in the form of large irregular warts, of a black color. Professor Peck referred this disease, as well as that of the cherry-tree, to the agency of insects. Doctor Burnet rejected the idea of the

insect-origin of this disease, which he considered as a kind of fungus. * * * But whether caused by vitiated sap, as Doctor Burnet supposed, or by the irritating punctures of insects, which is the prevailing opinion, they form an appropriate bed for the growth of numerous little parasitical plants of fungi."

Doctor Fitch claims to have made a careful investigation of this subject, and as his observations are quite accurate we quote again from his address: "There has been much speculation as to the cause and true nature of these excrescences. * * Most persons suppose them to be of insect origin. The larvæ of the curculio are almost always found in them, and these larvæ consume nearly all the spongy matter of the warts, but do not touch the little fungus growing on their surface, which remains, forming a kind of shell after the whole inside is devoured. But as these excrescences are sometimes found wholly free from curculio larvæ and all other worms, it is obvious they are not the cause of their growth. * * Suffice it to say that now, having carefully examined these excrescences from their commencement onward through their subsequent growth, I am prepared to say, with the fullest confidence, that the microscope shows nothing whatever about them, externally or internally, indicating that an insect has anything to do with causing them." Then, after giving his views as to what constitutes a fungus, he says: "We arrive at the conclusion that these excrescences are not of insect origin, and are not a vegetable fungus, but are properly a disease of these trees, in many respects analogous to the cancer in the human body."

Mr. Walsh, whose definition of black-knot we have already quoted, agrees with Dr. Fitch in concluding that the excrescences are not of insect origin. He also claims to have carefully watched the black-knot through all its stages from its earliest commencement to its complete maturity. He affirms that he bred from the galls five distinct species of insects beside the curculio, but that not one of these could be considered a true gall-maker. He therefore very justly concludes that the excrescences are not of insect origin, but of fungoid origin; and this conclusion, we may add, is entirely in accordance with our own view of this subject. Our reasons for adopting this view are briefly these:

1st. The excrescence itself is similar in structure to other excrescences which are known to be of fungoid origin, and at the same time it is quite dissimilar to most insect-galls produced in twigs and young branches.

2d. The time of its development is opposed to the probability of its insect origin. We are well aware that our knowledge of insect-galls is extremely limited, and that here we are treading on dangerous ground, and may hereafter be obliged in our turn to apologize to the entomologist; but, so far as our observations extend, insect-galls are developed in the warmer seasons of the year, *i. e.*, in spring, summer, and possibly early autumn. Those that continue to be the domicile of the young insect during the winter are, so far as we have observed, fully grown in autumn, and do not increase in size the following spring, a character which does not hold good in the case of black-knot.

3d. The fungus is always present with the excrescence, and its mycelium may be detected even in the earliest manifestation of the tumor, and this fungus is never found apart from the black-knot. To our minds this alone is a sufficient argument for our belief in the fungoid origin of the excrescence. Who ever heard of any undoubted insect-gall being *always* accompanied and inhabited by a fungus? On the other hand the larvæ of insects are not always present in the excrescence, and of those insects that have been bred from it, none, we are told, have been true gall-makers. It is true, members of the cynips family are gall-makers, and the learned Schweinitz constantly associated a cynips with his descriptions of this fungus, but then he did not affirm that the cynips produced the excrescence, and later investigators have failed to confirm his apparent suspicions. Hence we do not think his mere association of the two can have much weight either way.

Like others, whose writings we have quoted, we also claim to have examined the black-knot carefully in its various stages of development, not entomologically, it is true, but botanically, from which it is not unreasonable to suppose that we may have observed some details in its development which escaped their notice. We desire, therefore, to express the results of our own observations, and we desire this the more because in one or two points we cannot quite agree with the inferences and conclusions of former investigators.

If the smaller branches of a cherry-tree that is suffering from an attack of black-knot be carefully examined in November, some of them will be found to be slightly swollen for a little distance immediately below the excrescences. The cuticle of the bark will be cracked open here and there, revealing the soft tissues of the inner bark. If a minute portion of this inner bark be examined by the aid of the microscope, slender-jointed filaments or threads may be seen, that have insinuated themselves among the bark-cells. These threads are the primary vegetating condition of the fungus and are known to botanists as *mycelium*. During the winter the enlargement of the branch remains nearly or quite stationary, but with the advent of spring and the renewal of vegetable activity, the tumors increase in size, the chinks in the bark become wider and more numerous, and, by the end of May, small dark-green stains are

visible in the crevices of the bark. These greenish patches gradually increase until in some instances they completely cover the whole surface of the excrescence with a soft velvet-like coat. Such specimens were once sent to me from the West, where they had been pronounced by a scientific journal to be a new species of black-knot. A microscopic examination of this greenish coating reveals the fact that it is composed of innumerable upright jointed flexuous threads or flocci which bear upon their summit oval or oblong spore-like bodies, at first simple, but soon becoming one or more septate. This is the first external development of the fungus, and in the systematic classification adopted by botanists it belongs to the genus Cladosporium. This genus, however, we apprehend is destined to be overthrown, its species being only an early form of development of species of Sphæria. Indeed those celebrated European mycologists, Tulasne and Cooke, already deem the very common *Cladosporium herbarum* to be only a condition of *Sphæria herbarum*. And here we have another quite clear case of a similar dimorphism, for I have never yet seen a young black-knot excrescence of the cherry-tree in spring on which I could not detect the Cladosporium. In a few weeks this Cladosporium growth is succeeded by numerous minute black globular bodies scarcely as large as the head of a small pin. These usually cover the whole surface of the excrescence, and are often so closely crowded together that they partially lose their globose form. This stage of the fungus development, has evidently been mistaken by some for its complete development. In the work of Harris, on *Injurious Insects*, we find the following statement in reference to this fungus: "They come to their growth, discharge their volatile seed, and die in the course of a single summer." And in the *Practical Entomologist* for March, 1866, we find this statement: "Toward the middle of August, the new black-knot, having perfected its seed, gradually dries up and becomes internally of a reddish-brown color. In other words, like so many other annual plants, it dies shortly after it has perfected its seed." Again, in the March number for 1867, Mr. Walsh says, "I showed that black-knot is nothing but an assemblage of minute funguses, which perfect their seed or 'spores,' as botanists term it, the latter end of July; and that consequently, as this fungus is an annual plant, by cutting off and destroying the black-knot early in July its further propagation may be effectually stopped."

Now, according to all of our observations, the seed of the fungus is not perfected in July and August, nor indeed until some months later. Externally, it is true, the fungus appears to have attained its full development, but if one of these little black globes—*perithecia*, they are called by botanists—be taken from the tree at this time and crushed on the side of the microscope and its contents examined, little oblong pale membranous sacks will be seen. They are not all equally developed, and are evidently rudimentary. If we again examine the contents of some of the perithecia collected at a later period, say in November, we shall find that our rudimentary sacks have increased considerably in size. They are now cylindrical and contain a greenish grumous endochrome from which the spores are destined to be formed. The earliest period in which we have found the spores developed is the middle of January. In specimens collected January 13, spores were found in a few of the sacks, but most of them were yet filled with their greenish contents.

We have found spores in specimens collected as late as June; therefore the time in which the fungus perfects its seed may be said to be from January to June. Thus it will be seen that the plant is not an annual, as some have affirmed, but one that requires from fourteen to twenty months from the time of its first manifestation as an incipient excrescence to the time of the maturity of its seed; and from eight to fourteen months from the time of its first external appearance as a plant to the perfection of its seed. If we accept the knife as the sovereign remedy for this pest of our fruit-trees, these facts have an important bearing in determining the proper time for cutting off the excrescences. Some report that they have tried this remedy without success. Want of success may be ascribed to three causes:

1st. The remedy may not be employed at the proper time. If the black-knots be trimmed off in summer or even in spring, it is evident that the trouble will not be effectually cured, for the whole or part of a crop of spores will already have been disseminated to produce new excrescences the following autumn and spring. It is true if the cutting process be carefully repeated at sufficiently short intervals, it would in the end accomplish the desired result if done at any time, provided the tree could endure the frequent repetition of the operation. But, in our opinion, November is the best time for cutting off and destroying the knots. At this time the coming crop of spores is not mature, the leaves do not hinder the ready detection of the swellings, and the young excrescences, the foundation of a second succeeding crop, are also then visible to a close observer, so that thorough work may be done at one operation.

2d. The operation may not be properly performed. Physicians, in the excision of a cancer from the human body, insist upon the necessity of an entire removal of every particle and fiber of the extraneous growth. So in this case we must insist on the complete removal of all the affected part of the branch. It has already been stated that in November new swellings appear just below the old excrescences. Should the old excrescence be cut off just before the appearance of this new swelling, it is quite

possible that a part of the affected branch may be left behind, since the new affection sometimes extends down the branch several inches. Should any such part be left behind, it would develop into a new excrescence. It would be interesting to know whether these apparent extensions of the excrescences are the product of a new sowing of the spores or are produced by an advance of the mycelium of the old tumor just above. It certainly looks, from the frequency of this occurrence, very much as if the mycelium, having fulfilled its mission to the old excrescence in waiting for and aiding in the full development of the perithecia, then leaves these to produce their spores without further aid, and with an industry worthy of a better cause pushes its way down the branch through the soft tissues of the bark and exterior sap-wood to lay the foundation of a new colony.

3d. The cutting may be done at the proper time and done thoroughly, and yet the trees may continue to be attacked by this wretched malady. An indolent neighbor may neglect to prune his trees, and thereby raise successive crops of spores to be wafted by the winds to the trees of his more careful and diligent townsmen. Or there may be wild-cherry and plum trees in the neighboring copses or groves which are perpetuating the fungus and sending out each spring a shower of spores to fall upon the cultivated fruit-trees of the vicinity.

Hence, if we would overcome this enemy, there must be a combined and unanimous effort against him, and skirmishers must be sent out to dislodge him from the surrounding hills, woods, and waste places. I see no reason why united and well-directed efforts in this direction may not rid us of this miserable pest.

Having thus dwelt at some length on this subject, we will briefly notice one or two inferences which we find in the articles in the Practical Entomologist from which we have quoted. We would not even notice these did we not believe them erroneous and fraught with mischief. It is stated that "about the last of July or the first week in August, there grows from each fungus on the surface of the black-knot a little cylindrical filament about one-eighth of an inch long, which no doubt bears the seed, or spores, as they are technically termed, of the fungus, and that these filaments will shortly afterward fall off and disappear, leaving behind them the hemispherical plates, which alone had been hitherto noticed by botanists. * * I discovered that the filaments not only cover the entire surface of the black-knot itself, except where a few of them had fallen off, but that they were thinly studded over the twig for an inch or two above and below the swollen black part."

We do not pretend to say what these little filaments were, not having seen them, but it is very evident, from the fact that they extended on the twig an inch or two above and below the swollen black part, that they had nothing whatever to do with the bearing of the spores of this fungus, for its spores, we have seen, are produced in little sacks within the so-called hemispherical plates, which do not extend beyond the swollen part, and besides the spores are not mature until long after the assigned time of these filaments. Once only have we observed anything to correspond somewhat with the description of them. In the latter part of August we collected specimens of black-knot on the wild-cherry, *Prunus Pennsylvanica,* some of the perithecia of which had a little cylindrical rostrum or beak growing from the apex. But all these perithecia, when cut open, were found to be black inside and entirely barren, while those without filament or beak even on the same excrescence were white inside, as in the normal condition, and contained rudimentary sacks. We have also frequently seen perithecia without the beak that were black inside. These were in every instance sterile.

We quote once more, this time in reference to the second inference: "But from the evidence which will be adduced below, it appears to follow as a necessary consequence that the black-knot on the cherry is caused by a distinct species of fungus from that on the plum." Then the evidence is adduced, which consists in plum-trees sometimes being attacked while cherry-trees in their vicinity escape, or the reverse. Then these words follow: "The practical inference to be drawn from the above theory is that plum-growers need not be alarmed when their neighbors' cherry-trees are swarming with black-knot, and cherry-growers need not be alarmed when their neighbors' plum-trees are infested in the same manner; for the disease can only spread from plum-tree to plum-tree, and probably from the wild red-cherry on to our tame-cherry trees."

We are not disposed to dispute the correctness of the observations from which this inference was drawn, but we do believe the inference to be incorrect and calculated to lull fruit-growers into a feeling of false security. We have carefully examined good fruiting specimens of the black-knot fungus taken from the choke-cherry tree, *Prunus Virginiana,* the cultivated cherry-tree, *Prunus Cerasus,* and the cultivated plum-tree, *Prunus domestica,* and we are prepared to state that there is no essential difference between the black-knots of these trees. The spores in all are essentially alike and mature at the same time. There is a slight difference in the general external appearance of the black-knots of the different trees, but this is all, and no good botanist would venture to consider such a difference to be alone of any specific value. We have time and again observed plum-trees and cherry-trees along the same fence and in the same inclosure alike infested by black-knot. We have seen plum-trees badly infested in localities where the wild-plum tree does not occur at all. We therefore conclude that

the black-knot of both plum and cherry trees is produced by the same species of fungus, viz, *Sphæria morbosa*, Schw., and that it can and does spread from cherry to plum trees and from plum to cherry trees, and therefore that there is no safety for some cherry-trees in the vicinity of affected plum-trees, nor for some plum-trees in the vicinity of affected cherry-trees. We admit that there are certain species both of cherry and of plum trees that do not seem to be liable to the attacks of this fungus, which perhaps is the origin of the theory of distinct species of black-knot. Having thus briefly noticed the prominent features in the discussion of this question and added our own observations and conclusions, we dismiss the subject, hoping that ere long we shall be prepared to combat this foe to our fruit in a judicious and successful manner.

Respectfully submitted.

GEO. VASEY,
Botanist.

Hon. FREDERICK WATTS,
Commissioner.

RECLAMATION OF SWAMP AND OVERFLOWED LANDS IN CALIFORNA.

The great central valley of California, drained by the Sacramento and San Joaquin Rivers, together with the low lands bordering San Francisco Bay and its branches, is sometimes called the "Delta of the Pacific." This region embraces a vast area of swampy and partially submerged lands, which, till lately, were esteemed as practically worthless for agricultural purposes. Within a few years, however, the opposite opinion has gained ground, and the public mind has been occupied with numerous projects for reclaiming these lands, thus materially enlarging the productive area of the State. Partial experiments in cultivation had shown them to be richly endowed with elements of fertility. Their central position near the great commercial mart of the Pacific coast, and the facilities for the cheap marketing of agricultural produce presented by the navigable waters upon which they are located, had long attracted the attention not only of agricultural men seeking an opening for farming enterprise, but also of the people of San Francisco, who were especially interested in securing an increased production. When, therefore, the idea of reclamation began to assume a practicable aspect, it found a very favorable reception, and has since attracted an increasing public confidence.

Large amounts of both native and foreign capital have been enlisted in reclamation enterprise, which has assumed the character of a great financial movement, causing many persons to look upon it as simply a gigantic scheme of speculation. This view is strongly urged by an intelligent correspondent of this Department, who is satisfied "that no system of reclamation, the cost of which will justify the end, can be inaugurated in our State." But such conclusions, merely negative and untested by experiment, will have but little weight. The prospective advantages of the proposed improvement are so obvious and great that the public mind cannot be persuaded to resign them without a worthy effort for their realization. A certain amount of feverish speculation, such as embarrasses every great industrial or commercial movement, will be accepted, in advance, as part of the price at which this great public benefit is to be secured.

PRELIMINARY EFFORTS AT RECLAMATION.

The policy of reclamation having been accepted, at least tacitly, by the public as one of the necessities of progress, the preliminary efforts to realize it in practice were such as might have been expected from the

lack of experience and undeveloped resources of that day. The General Government, feeling itself incompetent to deal with local interests of this character, devolved the responsibility upon the State, to which it granted all the swamp or overflowed lands within its borders. The State legislature in turn left the practical solution of the problem to the people of each separate locality. The statute of March 28, 1868, prescribed methods by which landed proprietors, owning more than half the area included in any particular "body of swamp and overflowed, salt-marsh, or tide lands, susceptible of one mode of reclamation," might incorporate themselves into an association for reclamation purposes. Having determined upon such an organization, the parties interested are directed to present to the board of supervisors of the county within which the lands are located, a petition praying for their incorporation into a reclamation-district, and setting forth an accurate description of the lands proposed to be reclaimed. After the performance of specified requirements as to publication, &c., necessary to give due notice to all parties in interest, the board of supervisors, if they find the facts correctly represented, and that no lands have been improperly included in the proposed reclamation-district, note their approval, and the papers are spread upon the county records, giving a corporate character to the proposed organization. The corporators then elect a board of three trustees to superintend the execution of the works. They are authorized "to employ engineers and others to survey, plan, locate, and estimate the cost of the work necessary for reclamation, the land needed for right of way," &c. This cost is then assessed upon all the lands included in the reclamation-district by a board of commissioners appointed by the county board of supervisors. These assessments are reported to the county treasurer, who collects them, with other taxes, and pays out the proceeds upon the order of the board of trustees of the district. To encourage the reclamation of lands under this law, by the spontaneous action of the proprietors, it was further provided that the lands granted to the State by the General Government as swamp or overflowed lands should be sold at $1 per acre, in gold, which sum was to be refunded to the purchaser upon the completion of a system of reclamation-works executed according to law.

The methods of operation proposed by this law were eminently judicious considering existing circumstances. They stimulated local action and inaugurated a series of experiments which, though frequently unsuccessful, and sometimes, perhaps, disastrous, nevertheless bore good fruit in revealing more clearly the nature of the work to be done, and the fundamental conditions of final success. Local enterprise, though prompt to recognize the more obvious abvantages of public improvement, is too prone to a narrow and microscopic economy, and too impatient to secure immediate results, to appreciate the policy of a large and judicious expenditure. In some cases very simple and inexpensive works were found sufficient to rescue large isolated tracts from the waters, and to secure them against the highest floods that have been known since the settlement of the State. But the success of these methods in a few localities was calculated to mislead enterprise in other localities. Numerous ill-considered efforts were made to grapple with natural difficulties by means of cheap and inadequate processes, resulting in serious losses to the parties concerned. To meet those difficulties it was found necessary to enlist broader and more intelligent public interests and to bring to bear the resources of large capital and engineering science. Large combinations are necessary to secure not only the greatest but also the most economical results. This truth, so necessary to the comprehension of the problem, was recognized only after experience had

shown the inadequacy of mere local organization to accomplish general results. It is now seen that an adequate system of reclamation must be based upon more liberal views of public interest, and must be organized upon a broader basis.

RECENT COMBINATIONS.

For the reclamation of the swamp and overflowed lands of California, several associations of native and foreign capitalists have been lately formed. Among these the most imposing and extensive is the Anglo-American Syndicate. This is an association of English and American capitalists, with a capital stock of $5,000,000. It proposes to purchase and reclaim, by scientific processes, large bodies of swamp and overflowed land and sell it, after reclamation, to actual settlers in small tracts, on easy terms, and at prices as low as is consistent with the return of a fair interest on the capital invested; or it will lease land to cultivators on shares, a specific mode of cultivation being agreed upon. The Syndicate is to use its influence in Europe to secure a direct immigration to California of small capitalists and agricultural laborers. To such, lands will be sold as above on long credits, and money will be advanced to pay expenses of transportation and settlement. The general interests of the Syndicate will be supervised by a board of directors in London, while its local administration will be controlled by a board of management at San Francisco. It was stated that under this arrangement 50,000 acres of salt-marsh lands lying upon the bay of San Francisco and its branches had been secured, besides 250,000 acres of fresh-water lands lying upon the Sacramento and San Joaquin Rivers. According to the latest advices of this Department, however, this arrangement had either failed or had been suspended. The reason alleged for this suspension was the dissatisfaction expressed by some of the English legal advisers of the Syndicate with the tenure of the lands proposed to be purchased. It should be remembered that a large portion of the best lands of California are held by virtue of old Spanish and Mexican titles, a class of tenures in California which has given rise to extensive and vexatious litigations.

The Tide-Land Reclamation Company was organized about three years ago, with a nominal capital of $12,000,000. It has already purchased 120,000 acres of land lying in the delta of the Sacramento and San Joaquin Rivers. This area embraces the greater portion of Roberts, Union, Grand, Twitchell, Andros, Brannan, and Staten Islands, with some large tracts on the banks of the rivers adjoining the uplands. Portions of this land have since been sold after reclamation; other portions are being cultivated either by the company directly or by its lessees. Other companies and firms have purchased largely of these swamp-lands, besides many private individuals, and are engaged with very encouraging success in their reclamation and cultivation.

AREAS OF OVERFLOWED LANDS.

The area of swamp or overflowed lands in California is variously estimated from 2,000,000 to 5,000,000 acres. The surveyor-general of the State land-office places the aggregate at 3,000,000 acres. Of this area about 400,000 acres are called tide-lands, being located upon the arms of the sea or within the range of tidal influences upon the rivers Sacramento and San Joaquin. These lands are subdivided, about equally, into salt-water and fresh-water tide-lands. The former are all found below the head of Suisun Bay, which receives the waters of the Sacramento and San Joaquin Rivers. The latter lie between the mouth of those rivers and a line drawn across their valleys from Stockton, on the San Joaquin, to a point six miles above the head of Steamboat Slough, on

the Sacramento. The lands above that line are unaffected by the tides. Very little attention has as yet been devoted to the last-named class of lands on account of their distance from the market.

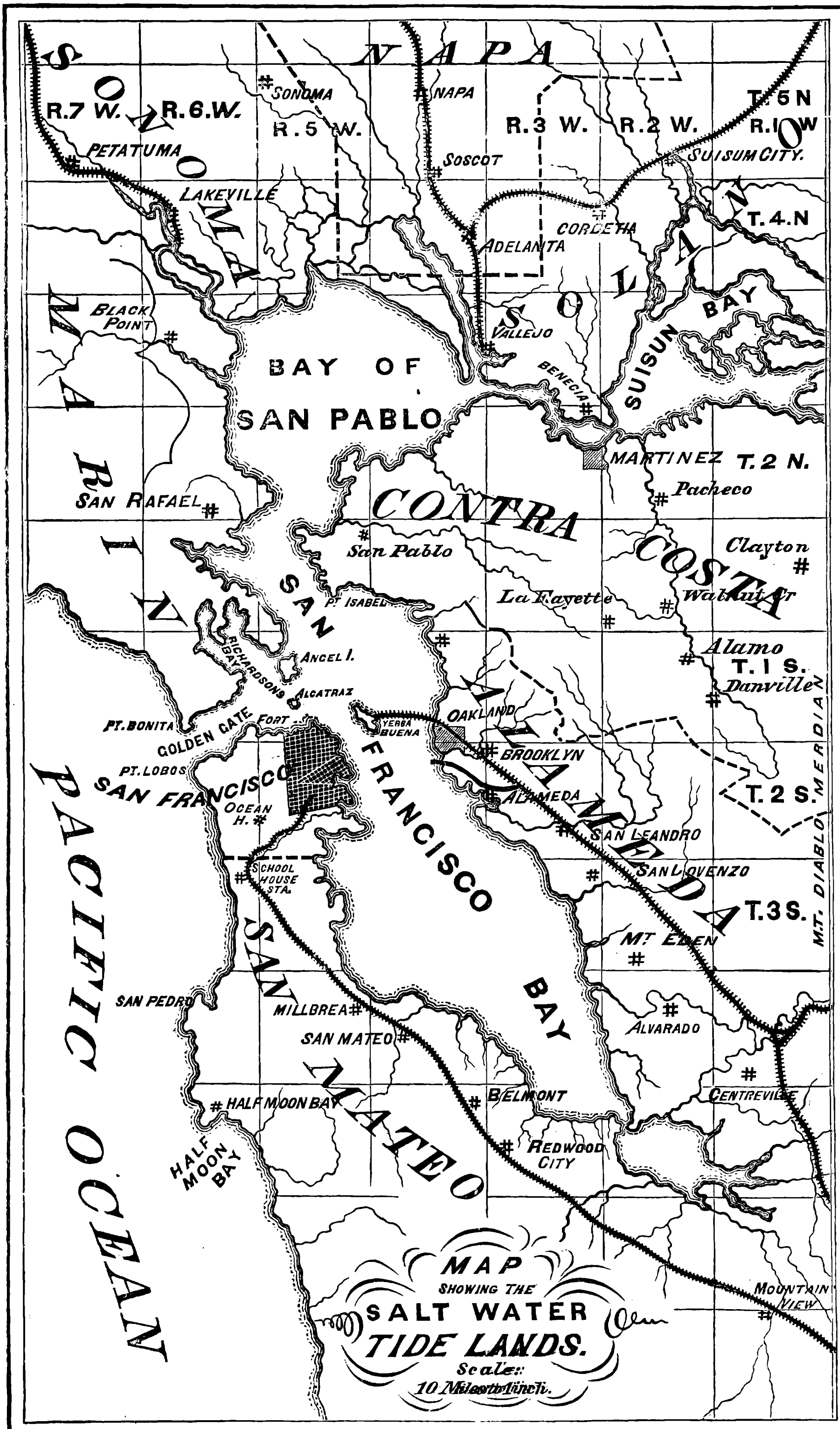
SALT-WATER TIDE-LANDS

These lands all lie upon the shores and islands of San Francisco, San Pablo, and Suisun Bays, and differ in several important characteristics from the fresh-water tide-lands upon the rivers. The lands on Suisun Bay, however, assimilate more closely to the fresh-water lands above, from the fact that the waters of that bay are but to a small extent of a saline character. For nine months in the year—from November till September—the tides are so low that the water is excellent for drinking purposes. During the remainder of the year it is but slightly brackish, and is readily drunk by live stock. Hence, upon the islands of this bay there are many tracts resembling the tule-swamps. These tracts are reclamable at a comparatively small expense, seldom exceeding a *pro rata* of $3 per acre. Long Island is thoroughly protected from inundation by a levee 12 feet wide at the base and less than 4 feet high. This embankment resisted the unusually heavy storms of the winter of 1871–'72 without the slightest injury to the works. In fact, it was drier than the highlands surrounding the bay. The levees of Grizzly and Joice Islands, of about the same dimensions, were equally intact. The highest floods of the Sacramento and San Joaquin, which usually occur in January and February, do not raise the waters of Suisun Bay more than a foot above the highest summer-tides, the rise and fall of which do not extend above six feet. By placing gates in the embankment at proper intervals an ample supply of water for irrigation during the growing season can be secured, which insures the success of the crops. This is the nearest land to San Francisco that enjoys this advantage of inexpensive fresh-water irrigation.

The shore-line of the lower bays is much cut up by sloughs, which, though valuable for drainage, offer serious obstacles to extensive farming, as but few acres can be found in a body. The work of construction embraces an embankment about 4 feet high, with a base 12 feet wide, the intervening sloughs being dammed. The work has of late been prosecuted with great energy, and from one-third to one-half of the marshes of San Francisco Bay have been included in works of reclamation now under construction or completed.

The preliminary survey of marsh-lands, lying upon San Francisco Bay, was accomplished by a board of State commissioners, who, in their report of 1872, presented a statement of their nearly-completed labors. They had made a final survey of the lands subject to their jurisdiction, amounting to 65,200 acres, and located in sections extending from a point in Marin County, north of San Francisco, round the southern extremity of the bay, and along its eastern shore to a point a few miles north of Oakland. The lands along San Pablo and Suisun Bays were not embraced in this survey. Of the total area surveyed, 33,200 acres—over half—were reserved for basins, channels, and tidal area. This reservation quieted a grave public anxiety in regard to the danger of shoaling the water at the entrance of the bay by contracting the tidal area. In this policy the commissioners profess to have been influenced by the highest hydrographic authorities. Of the remainder of the lands surveyed, 13,200 acres were found to be covered by State patents and legislative grants, leaving 18,800 acres to be disposed of by the commissioners. Of this latter aggregate, 14,400 acres had been sold for $1,447,929.92. The total expenses of survey and sale amounted to

PLATE VI.



MAP
SHOWING THE
SALT WATER
TIDE LANDS.
Scale:
10 Miles to 1 inch.
NAPA
SONOMA
SOLANO
MARIN
CONTRA COSTA
ALAMEDA
SAN MATEO
SAN FRANCISCO
PACIFIC OCEAN
BAY OF SAN PABLO
SAN FRANCISCO BAY
SUISUN BAY
HALF MOON BAY
GOLDEN GATE
RICHARDSONS BAY
R.7 W.
R.6.W.
R.5 W.
R.3 W.
R.2 W.
R.1 W
T.5 N
T.4.N
T.2 N.
T.1 S.
T.2 S.
T.3 S.
MT. DIABLO MERIDIAN
SONOMA
NAPA
PETATUMA
LAKEVILLE
SOSCOT
SUISUM CITY.
CORDELIA
ADELANTA
VALLEJO
BENECIA
MARTINEZ
Pacheco
Clayton
Walnut Cr
La Fayette
Alamo
Danville
BLACK POINT
SAN RAFAEL
San Pablo
PT. ISABEL
ANGEL I.
ALCATRAZ
FORT
PT. BONITA
PT. LOBOS
YERBA BUENA
OAKLAND
BROOKLYN
ALAMEDA
SAN LEANDRO
SAN LOVENZO
MT. EDEN
ALVARADO
CENTREVILLE
OCEAN H.
SCHOOL HOUSE STA.
SAN PEDRO
MILLBREA
SAN MATEO
HALF MOON BAY
BELMONT
REDWOOD CITY
MOUNTAIN VIEW

$235,434, leaving a balance of $1,242,495.92, besides 4,400 acres unsold. The legislature had enacted that from this fund a perpetual annuity of $50,000 should be added to the endowment of the State University, a draft which it was amply competent to meet.

The duty of this commission embraced only the survey and sale of the lands. The actual work of reclamation was left to the individual proprietors. The cost of a connected series of works around San Francisco Bay, executed upon scientific principles, was estimated by Messrs. Hoffman and Poett, hydrographic engineers of San Francisco, at $409,322. The plan proposed embraced an embankment 15 feet wide at the top and 5 feet above the level of the salt-marsh. Flowing streams were to be leveed, and intermediate sloughs were to be dammed by means of sheet-piling and embankment. This estimate embraced 48,150 acres of swamp-land, most of which had passed into private hands, though a portion still remained at the disposal of the State authorities. The average cost of purchase, prior to reclamation, was estimated at $15 to $20 per acre; their value subsequently could not be less than $100 per acre. The total outlay necessary to be made by an association of capitalists undertaking to reclaim and dispose of these lands would not exceed $1,131,572, while their income from the sale of reclaimed lands would amount to $4,815,000, leaving an enormous profit of $3,683,428. The work now going forward for the reclamation of these lands appears to be less expensive and thorough than that provided for in the above estimate. How far it will meet the demands that will be made upon it remains to be seen.

General Alexander, of the United States engineers, speaking of the Beard and Coryell tracts, included in the above estimate, says that their complete reclamation is entirely practicable at a small outlay. The tide rises but a foot above them ordinarily, and but 2 feet during the highest storm-tides. The river-floods have but a slight influence upon the general level of the bay. A dike of 4 feet is ample to protect them against the greatest emergencies. When this land is relieved of salt water it may be freshened in a single season, at least sufficiently for grasses, by being flooded with fresh water from Alameda and Coyote Creeks, or from artesian wells. Two or three floodings during the rainy seasons will be sufficient to leach out all the salts with which the land is impregnated. The soil is alluvial, and promises excellent results when cultivated in gardens and meadows. It is susceptible of easy irrigation, and, for dairy purposes alone, will speedily command a high market value. The facilities for transportation, by water and rail, bring the products of these lands within a few hours' carriage of San Francisco. The same advantages are reported in regard to different portions of the salt-marsh tracts located upon San Pablo and Suisun Bays.

FRESH-WATER TIDE-LANDS.

The fresh-water tide-lands are about equal in area to the salt-marshes just described, or about 200,000 acres. They are located upon the Sacramento and San Joaquin Rivers, below the line before mentioned, which passes from Stockton to a point six miles above the head of Steamboat Slough, which line represents the limit of tidal influence. The valleys of these rivers present some very noticeable features. According to current geographical theory the channels originally occupied the lowest points in the valleys. The annual overflows, by the deposit of sediment, gradually raised the immediate banks of the streams from 10 to 20 feet above the areas in their rear. Into these depressed areas the streams from the foot-hills discharge their waters till the dry season arrests their

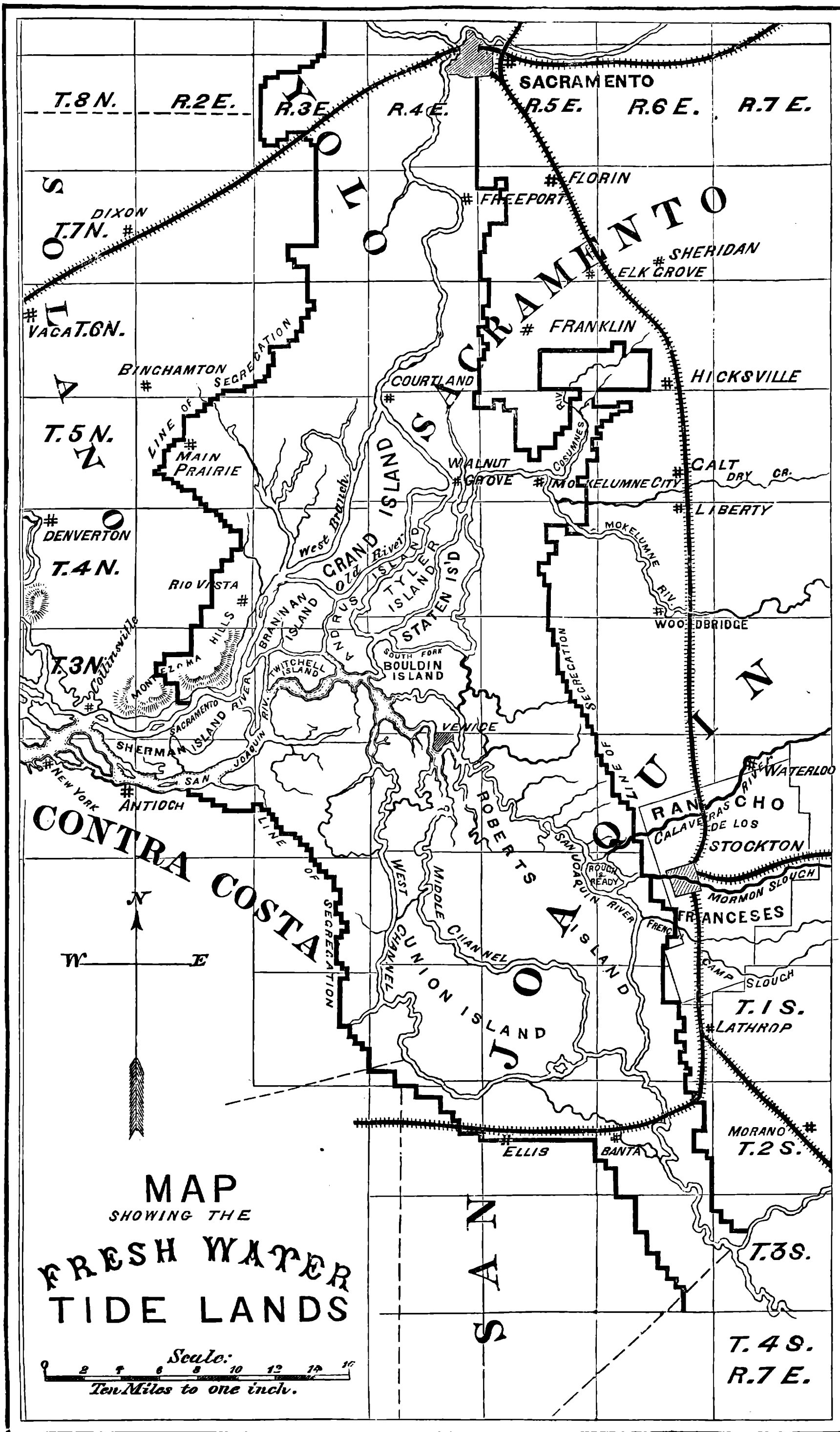
flow. The surplus waters of the great river-floods also deluge these tracts, keeping them submerged during several months and maintaining a wet and swampy condition during the remainder of the year.

These overflowed areas are called "tules," an Indian word signifying a coarse, reedy grass, which grows luxuriantly upon the wet soil, and which is now used to designate the lands themselves. These tules border the rivers and their larger tributaries for a very large portion of their respective courses. In the upper part of each valley their edges are from half to three-quarters of a mile from the rivers, but toward their mouths this intervening space becomes narrower. The banks decline in height and the rivers cut numerous channels, called sloughs, through the tules, forming a great number of islands of various sizes, and separated mostly by navigable streams. This multiplication of channels gives a greater scope for the periodical high waters than do the narrower upper portions of the valleys, and hence the floods are more easily controlled. This renders the process of reclamation in the fresh-water tide-lands easier and less expensive than in the regions above, where, as yet, but little has been done in that way.

The characters of the two rivers, the Sacramento and the San Joaquin, present some marked differences, which are illustrated by corresponding differences in the lands on their banks. The Sacramento is a more violent stream. Its large tributaries head high up among the Sierras and bring large bodies of water from the melting snows, which are precipitated more suddenly than the floods of the San Joaquin. The Sacramento has also a smaller number of channels through which to discharge its surplus waters. To relieve this difficulty it has been proposed to cut an artificial channel from Caché Slough, through the Montezuma Hills, to one of the streams farther west, emptying into Suisun Bay. It has been estimated that this channel will be but seven miles long, with a declivity ranging from 2 to 14 feet per mile. The tributaries of the Sacramento have also been the theater of a more extensive mining enterprise, the *débris* of which, discharged into the river, have given a specific character to the sediment it deposits upon the lowlands.

The islands of the Sacramento are generally basin-shaped, their interior parts being depressed below their edges. Their banks, like those of the riparian tules higher up, are studded with willow, alder, sycamore, live-oak, and other large timber, interspersed with a copious undergrowth of shrubs and vines. The centers of these islands are covered with tules of a very tall and luxuriant growth. The islands of the San Joaquin do not exhibit so decided a tendency to this basin-like formation. Their edges are not so elevated, nor are they so covered with vegetation, while in their interior parts the tule is thinner and shorter. Willows here grow in bunches, and different kinds of coarse grass are found successfully maintaining themselves against the aggressive tules. The surface-soil of the Sacramento islands is, to a great extent, composed of clay, or a late deposit of yellow sediment, with a substratum of almost pure organic matter in an advanced stage of decomposition. In the islands of the San Joaquin, this organic matter is seen almost entirely uncovered by later deposits.

The tules of the islands and banks of these two great rivers, though exhibiting these very perceptible differences, present points of general resemblance indicating a common origin. They first appear above the Straits of Carquinez, which connects San Pablo Bay with Suisun, and assume a more marked character as the water becomes less and less brackish. Above the mouth of the rivers the alluvial clay-soil of the salt-marsh, impregnated with alkali, gives place to the fresh-water tule-soil, composed of decayed roots and grasses and other organic matter


MAP
SHOWING THE
FRESH WATER
TIDE LANDS
Scale:
0 2 4 6 8 10 12 14 16
Ten Miles to one inch.
SACRAMENTO
YOLO
SOLANO
CONTRA COSTA
SAN JOAQUIN
T.8 N.
R.2 E.
R.3 E.
R.4 E.
R.5 E.
R.6 E.
R.7 E.
T.7 N.
T.6 N.
T.5 N.
T.4 N.
T.3 N.
T.1 S.
T.2 S.
T.3 S.
T.4 S.
R.7 E.
DIXON
VACA
BINGHAMTON
MAIN PRAIRIE
DENVERTON
RIO VISTA
Collinsville
MONTEZUMA HILLS
FLORIN
FREEPORT
SHERIDAN
ELK GROVE
FRANKLIN
HICKSVILLE
COURTLAND
WALNUT GROVE
MOKELUMNE CITY
GALT
DRY CR.
LIBERTY
MOKELUMNE RIV.
WOODBRIDGE
COSUMNES RIV.
LINE OF SEGREGATION
West Branch
GRAND ISLAND
Old River
ANDRUS ISLAND
TYLER ISLAND
STATEN IS'D
BRANNAN ISLAND
TWITCHELL ISLAND
SOUTH FORK
BOULDIN ISLAND
SACRAMENTO RIVER
SHERMAN ISLAND
SAN JOAQUIN RIV.
NEW YORK
ANTIOCH
VENICE
ROBERTS ISLAND
WEST CHANNEL
MIDDLE CHANNEL
UNION ISLAND
SAN JOAQUIN RIVER
ROUGH & READY
FRENCH
RANCHO DE LOS FRANCESES
CALAVERAS RIVER
WATERLOO
STOCKTON
MORMON SLOUGH
CAMP SLOUGH
LATHROP
MORANO
ELLIS
BANTA
N
W
E

mingled in different proportions with sand, loam, &c., deposited by the river-floods. Upon the latter the tules are often seen of various heights, from 5 to 15 feet. This organic top-soil often extends downward to the depth of 30 feet, where it generally rests upon a substratum of hard clay. Some portions of the surface rise and fall with the tide and exhibit temporary undulations upon the passage of heavy animals or loaded teams. In many places long poles have been thrust to a considerable depth through the surface-crust "without touching bottom."

Four varieties of surface-soil among the tules have been described by intelligent observers. First, a coarse peat formed by the large roots of tule, decomposed into a rich, black, vegetable mold, which has produced some very remarkable crops of cereals; second, a stiff, blue clay, derived from the cretaceous hills bordering the valleys, more or less infused with alkali; this soil constitutes a strong and durable seed-bed for permanent grasses; third, a yellowish-brown clay deposited by the turbid waters of high floods. This variety of soil manifests its remarkable fertility in the copious growth of tule, wild grasses, and timber; fourth, a light, loose, sandy soil, deposited in limited localities by eddies. This soil is especially adapted to garden-vegetables, corn, and fruit. Partial efforts at cultivation have shown that all varieties of tule-soil will yield enormous crops of cereals, grasses, roots, fruits, &c. Its wild grasses are rather coarse, but it has been shown that the richest and most permanent pasture can be maintained. Experiments in tree-culture have not been wanting to show a special productive capacity in this direction. Promising experiments have also been made in rice-culture.

The correspondence of this Department exhibits numerous instances of crops raised upon these tule-soils that seem almost fabulous, though attested by some of the most intelligent and trustworthy gentlemen on the Pacific coast. Crops of 80 bushels of wheat, and of 100 bushels of barley, per acre, are not uncommon. A crop of wheat is followed by a second crop of "wheat-hay," gathered within the same year. Double crops of barley, onions, or potatoes, are regarded as a mere matter of course. Succulent grasses remain green the year round. All the varieties of fine vegetables grow often to enormous size and always of exquisite quality. Fruits rivaling the finest products of Pacific orchards here grow in great profusion. Though located so near the water-level, the circulation of fresh air from the ocean is a perfect preventive of malaria, mildew, and other maladies which infest both animal and vegetable life in other swampy districts of our country.

The peculiar character of the tule-soil precludes all cultivation by ordinary processes. In its wet state it is too soft, and in its dry state too tough, to be worked by any agricultural implements or machinery yet invented. The amount of organic and combustible matter in its composition has suggested another method of dealing with it. After being freed from the superincumbent waters it is set on fire and burned to a depth varying from 6 to 18 inches. The depth of the burning can be regulated by waiting a greater or less length of time after the removal of the water before applying the torch. This burning leaves the surface a bed of ashes, upon which the seed is sown broadcast. Instead of being harrowed into the ground with a harrow it is trampled in with sheep, which are driven in flocks across the field in different directions. One thousand sheep will easily tramp from 20 to 30 acres per day. This simple and original process has been found to be very effective and cheap. A large crop of wheat was thus placed in the ground at a total expense not exceeding $1.25 per acre. The grain on such a seed-bed exhibits a very remarkable propensity to stool, which limits the quantity of seed required for sowing. In a well-attested case mentioned in

the correspondence of this Department, a crop of 80 bushels per acre required an expenditure of only 30 pounds of seed per acre. After harvesting the first crop of wheat the waste grain left upon the ground, on being irrigated, brings forth a crop of wheat-hay in sixty or eighty days. This system of cultivation is yet in its infancy. What results may yet spring from it must, of course, be matter of mere conjecture. Apparently, however, it justifies its departure from the old methods by its common-sense adaptation to circumstances, as well as by its wonderful success.

The mode of reclaiming swamp-lands is by throwing up levees to keep out the tides and river-floods. Self-acting gates permit the escape of the water in one direction, while they prevent its return. The earth from which this embankment is constructed is taken from a ditch which is generally dug inside of the dike. Small sloughs or creeks are dammed in order to escape the expense of leveeing their banks. The drainage-gates are placed at the mouths of these sloughs, and serve also for the admission of water for irrigation during the growing season. This work was at first done by Chinamen, but several ditching-machines have been tried, some of them with substantial success. The cost of embankment varied from 10 to 25 cents per cubic yard.

The views of the parties who inaugurated the system of tule reclamation were too limited to embrace the conditions of final success. It was discovered that a dike that would be sufficient for the reclamation of the salt-marshes upon the bay, where the rise occasioned by river-floods is limited, would be wholly inadequate to resist the sudden and enormous pressure of inundation in the river-valleys during the rainy season, especially in those years in which the annual rain-fall reaches its periodical maximum. The climate of California exhibits a remarkably wide range of hyetal conditions, which, as yet, are very imperfectly understood. During the twenty-three years ending with 1871 the annual rain-fall at San Francisco varied from 7.60 inches, in 1850, to 49.27 inches, in 1861. The distribution of this rain-fall through the season is also very irregular, sometimes producing the most devastating floods. A system of reclamation works in such a region should be constructed with reference to the extreme pressure that is likely to be brought against them. The spring floods of 1872 were very destructive of these works, overflowing lands supposed to be sufficiently protected, and sweeping away crops and improvements. In some cases, it is said, the embankments were so unscientifically constructed as to force the waters upon lands that had not previously been overflowed. Persons anxious to secure as large an area as possible of new land encroached upon the channels, and thus raised the water-level above what it would otherwise have been.

These untoward results indicated the necessity of a more liberal expenditure and of more efficient construction. Large associations of capitalists have entered the field, purchasing and reclaiming overflowed lands in some cases for the purpose of selling them to individual cultivators, and in other cases to cultivate them themselves. It is stated in our correspondence that the reclamation works constructed during 1872 were higher and stronger than those previously existing. At the close of the year 1872, about 70,000 acres of fresh-water tide-lands had been inclosed by levees, and furnished with self-acting tide-gates. Some of these works were constructed upon the later models; others were enlarged and brought to a state of efficiency that was esteemed ample to resist extraordinary floods. The cost of these levees varied from $5 to $15 per acre, according to the height and strength of the embankment,

and to the shape of the reclaimed area. During 1873 enterprises of this character will be prosecuted upon an enlarged scale and according to improved methods.

Among the districts stated to have been reclaimed by the close of 1872 were Sherman Island, at the mouth of the rivers; Twitchell Island, Bouldin Island, Mandeville Island, Grand Island, and a large portion of the right bank of the San Joaquin. Brannan Island, Andros Island, and a large tract along the left bank of the Sacramento River were reported as nearly completed. During the last six months of 1872, about 25,000 acres of reclaimed land were sold to individual cultivators at an average price of $25 per acre, which is stated to be the general average of reclaimed but uncultivated land in the State. Cultivated lands on Sherman Island sold at $60 per acre, and were held as high as $75. Lands belonging to associations of capitalists are rented to cultivators, either on shares or for a specific sum of money per annum. In the former case the landlord generally demands one-fourth of the crops raised; in the latter from $10 to $20 per acre.

The Department is in receipt of letters from reliable parties living upon Sherman Island, Mandeville Island, Twitchell Island, Grand Island, and other localities, detailing the character and results of the cultivation of reclaimed lands, which uniformly attest the wonderful productive capacities of the soil. Sherman Island, containing about 14,000 acres, was the scene of the earliest enterprise in reclamation within the fresh-water tide-land region. Being nearer to San Francisco, it enjoys special facilities for marketing produce. The numerous channels through which the rivers discharge their surplus waters are a partial defense against destructive floods, rendering reclamation works less costly. Mandeville Island contains about 5,000 acres, which have been reclaimed at a total cost of $11 per acre. This island is about sixty miles from San Francisco. Grand Island, twenty miles farther up the valley, contains 17,000 acres, and is said to be better leveed than any tract below Sacramento City, the embankment being from 6 to 10 feet high and from 26 to 42 feet wide at the base. A deposit of sediment here overlies the tule-soil to a depth varying from 4 inches to 2 feet. The climate of these districts is equable, mild, and dry. They are penetrated with a net-work of navigable channels, which enables the producers to secure transportation to market as low as $1.50 per ton. Lands in these localities are rapidly rising in value and, at their present prices, seem to offer to cultivators with small capital an eligible opportunity of investment.

LANDS ABOVE TIDE.

The reclamation of lands above tide has, as yet, excited but little attention. The problem here assumes additional elements of difficulty on account of the narrowness of the upper valleys and the consequent greater rise of the floods. Until the salt-marsh and fresh-water tide-lands shall have been marketed it is not likely that these lands will be reclaimed to any great extent. Yet thoughtful men in California are giving timely attention to this new phase of the reclamation enterprise. Among the projects already conceived for the treatment of these lands is the proposition to inclose the higher portions of the mountain valleys with substantial dams, which during the rainy season will create immense reservoirs for irrigation during the growing season. This restraint of the waters during the rain-fall will limit the range of the floods in the valleys below, thus reducing the expense and labor of reclamation. How these ideas will be realized in practice remains for the future to develop.

MICROSCOPIC INVESTIGATION.

By Thomas Taylor, Microscopist.

PEAR-TREE BLIGHT.

"For nearly a hundred years blight of the pear has been a terror and despair to growers of its fruit." This disease is known under a variety of names—winter or frozen sap blight, leaf blight, summer blight, &c. It is quite different from insect blight. Since the temperature and hygrometric state of the atmosphere and the conditions of the soil, whether acid or alkaline, pulverous or stiff, affect fungi by either retarding or fostering their growth, it becomes a matter of interest to ascertain how far observations made in relation to pear-tree blight will agree with the fungus theory.

Some forms of fungus are favored by heat and dryness, such as the oidium of the European grape-vine, while the fungus of the native grapevine is favored in growth by moisture and heat. The first may be a saccharine and the second an acid fungus, being favored by the condition of the leaf and wood.

Yeast, which is a fungus of a low order, when in its active state always exhibits an acid reaction; if well washed, the globules become much less active; but by exposure for a few hours to the air their activity is restored, the acidity being thereby again developed. The addition of a small quantity of vegetable acids, such as acetic or tartaric, to washed yeast, immediately restores its activity, but when a larger quantity of acid is employed the process of spore-budding is arrested. The mineral acids, such as sulphuric, even in small quantities, immediately stop yeast fermentation; sulphurous acid acts in like manner. A small quantity of free alkali, or a strong solution of common salt, also prevents its fermentation. Nitrate of silver, corrosive sublimate, and sulphate or acetate of copper, check its growth immediately on application; also oxide of manganese, oxide of mercury, strychnia, small quantities of kreosote, oil of turpentine, and many other essential oils. When, however, the low forms of fungi once commence, the vegetable bases have no power of arresting although they may retard their progress. Boiling water, also, for a time arrests the progress of fungi. A knowledge of the habits of fungi and of the substances and conditions which retard or foster their growth will, to some extent, enable fruit-growers to modify fungus blight. But independent of all chemical appliances, drainage, and sheltering by belts of timber or hedges, would be of great importance, when the land or orchard is devoid of natural sources of protection. It is not simply to the conditions of high or low temperatures, or to the hygrometric state of the weather, that blight, rust, molds, &c., owe their origin, but to a combination of many conditions. Heavy rains on well-drained soil will not present the same conditions to vegetable growth which they would on poorly-drained. A favorable condition of soil and climate is required by foliage of spring, summer, and autumn, for a healthy performance of its functions. Under highly favorable conditions of climate and soil the wood becomes matured, and, consequently, the fruit and the leaves drop when, and only when, the uses for which they were formed have been accomplished. The wood of every tree when fully matured has condensed the sap, forming it into wood or other solid material; consequently the cells

under such conditions are comparatively empty, and have room for the expansion of any limited portions of sap remaining. Climatic derangement in the animal as well as in the vegetable economy is frequently produced from sudden changes of temperature. A mantle of ice, or of snow, will not necessarily prove hurtful to plant-life; flowers are sometimes found blooming under snow. It is from the unprepared condition of plants and trees that injury from frost mostly springs. It is not unusual for a shepherd on the mountains of Scotland, while tending his sheep, to save them from perishing in snow-drifts, to immerse his plaid in a brook, wring it out, and wrap it round himself. It freezes, and ice being a non-conductor of heat, he is kept warm in his frozen mantle. The Laplander lives in huts of ice or snow to shield himself and family from the bleak winds of winter. Ice, snow, and water are classed as non-conductors. It is when water is converted into vapor that the body from which it evaporates becomes cold. Millions of pounds of paraffine have been for a long period annually extracted from coal-oil by taking advantage of this principle; by the evaporation of ether in contact with a vessel containing coal-oil the paraffine freezes solid in the oil and is thereby easily removed. But it is not the cold, properly considered, which produces the disease owing to the bursting of plant-cells, but to the stoppage of the functions of assimilation in the presence of myriads of germs of fungi and infusorial life. Healthy plants will decompose any foreign substance suitable for their food and assimilate it in the support of their own function.

"Fungi consist of two principal elements, the vegetative and the fructifying. If we take, for example, the common mushroom, the vegetative is represented by the spawn which, for a time, carries on all existing functions of the plant; the fructifying by the stem, with the cap and gills, which bear nearly the same relation to the spawn as the flower with its various organs to the stem on which it grows. The spawn may flourish for years without bearing any fruit, but fruit can never be produced without spawn."

In entering upon an investigation of this kind, it is necessary, sometimes, to experiment with suspected wood-fibers taken from living or dead organic matters, with a view of developing to a higher state of growth the dormant germs. Some of the means employed consist in subjecting suspected specimens to a favorable temperature and moisture, and suitable food; in this way, sometimes, forms will be exhibited after the lapse of a suitable period, by which means the true character of the fungi is known. In examining pear-tree blight, I have taken advantage of such means to ascertain the presence of fungi in suspected portions of an affected pear-tree. I removed several portions of the bark from various points of the tree, and examined them with an object-glass of about one inch, which, for this purpose, may be considered a low power, but no mycelium was visible. I next placed specimens of the healthy bark and the blighted in separate vessels of water, to be macerated; in about eight days the blighted portions indicated the separation of the last cambium layer from the liber, which appeared as a translucent membrane, the largest portions of which were not over one-tenth of an inch, and did not exceed one-hundredth of an inch in thickness. When a portion of the flocculent matter was placed under an object-glass of about 250 diameters, its cellular structure was seen, well defined, and numerous dark-brown spores bounded most of the cell-walls. [See Fig. 27.] In some cases the cells exhibited nothing but dark masses of brown gelatinous matter, but when subjected to pressure and friction they were found to be masses of spores, all of the same

class and color. The healthy bark did not exhibit any spores under the same conditions. Fig. 27 represents the general appearance of the cellular matter, spores of the blighted bark in their arrangement, form, and depth of color. I treated blighted pear-tree leaves in a similar manner. On removing a portion of their epidermis to glass microscopic slides, by means of a knife, well-defined elliptical double-celled spores were seen, perfectly developed, under a one-eighth power, Fig. 28 represents the spores on a portion of a leaf-rib, all highly magnified. The cellular structure of the leaf, when viewed under a high power, appeared as at 2. About one-half of the cells were filled with a dark-brown opaque substance, the other half being highly transparent while 3 shows the appearance of the leaf blackened from internal disorganizations, and 4 represents a single stratum of mycelium which appeared on leaves that had been only partially submerged in water. It had a very fine silken appearance. From its great delicacy it could not be removed from its position, without injury, by any of the ordinary modes, as with a point; and in case spores were present their true positions could not be seen. To overcome this difficulty I prepared a very limpid solution of copal varnish, by combining one ounce of copal with ten of benzine, a portion of which I poured on a glass slide one inch by three, instantly allowing all the superfluous varnish to drain off. In about thirty minutes after this operation the mildewed leaf was pressed gently on the varnished glass, when the mycelium was transferred to it, owing to the slightly sticky character of the varnish. When mounted in the usual manner they may be photographed. The threads of the mycelium are not more than about the twenty-thousandth of an inch in diameter; from these short threads protrude, on the terminals of which grow bundles of naked spores, arranged as shown.

Fig. 27.

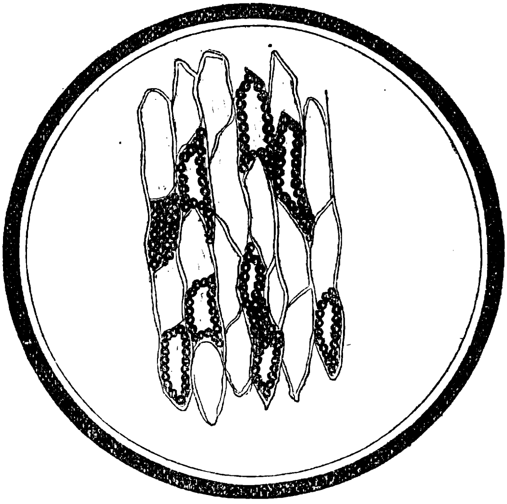
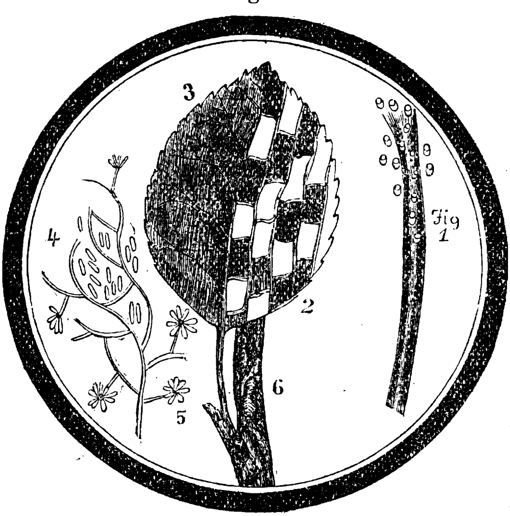


Fig. 28.



In my investigations of pear-tree blight, I have failed to discover any fungi inhabiting those portions of blighted bark which seem deficient of albuminous matter.

There may be periodic times when fruit-trees and cereals will attain great perfection in growth, and appear wholly free from external fungoid disease, notwithstanding the soil, either mechanically or chemically considered, is not of the most favorable character. Such appearances may lead to an extension of fruit-tree planting on such soil; but with a single unfavorable season the fruit-grower's hopes may perish with his trees and labors. Torulacei fungi seem ever present, waiting in undeveloped forms their time for action.

My present experience leads me to suppose that pear-tree blight is a local fungus fermentation of the genus Torula, and which may be developed under any one of a number of causes. Every condition that will prevent the bark and shoots from ripening will foster under high temperatures, in the presence of organic acid, (which is always present in green or unripe wood,) and vegetable nitrogeneous matter, one or more species of Torulacei fungi. Stagnant water in the ground containing the drainings of decomposing organic matter is always charged with Torulacei budding spores and germinal matter, which if absorbed by the roots will certainly contaminate the sap of the tree. When small branches are attacked it may prove best to remove them, but the main branches and trunk may be saved by prompt action. The stained bark should be removed as soon as observed, and before the stain has girdled the branch or trunk, as may be. If not removed the sap-wood will be poisoned. In the case of atmosphere blight, that is when the fermentation is produced from the immediate action of high temperatures on the outer bark, favored by previous conditions, the fermentation will proceed from the surface to the interior; but in the case of root absorption the fermentation will proceed from the sap-wood to the exterior. The removal of the tree to a more favorable place, or drainage, will probably save the affected tree in the case of root absorption.

Barry, on fruit-gardening, says, page 361, that "Blight has never been known to originate on the dry, sandy loam of Long Island, not even with heavy manuring, the drought of midsummer always ripening the shoots so completely that the leaves drop off long before frost commences."

Some interesting experiments have been prosecuted by Mr. William Saunders, superintendent of the Department grounds, in relation to pear-tree blight, particularly during the last two years. A pear-tree which was badly blighted on its main trunk was made the subject of special experiment. Nearly all of the bark was blighted within three feet of the ground, only about an inch and a half in width being left to connect the upper part of the tree with the unblighted bark at the base. The affected part was removed and the sap-wood left quite exposed to view; but to prevent injury from the air it was at once coated with a composition of carbolic acid, sulphur, lime, and water, and used as a paint. After the lapse of two years the tree has wholly recovered, and the denuded part is again covered with new and healthy bark. The tree in all respects presents a healthy appearance. Many other trees much affected with blight were coated heavily with the sulphur compositions, and have evinced marked signs of improvement. It is intended to continue these experiments on a larger scale, until sufficiently numerous and well-established facts attest the best mode of treatment. The Department grounds consist of a heavy, compact, partially undrained soil, lying low; they are therefore unfavorable for the highest development of pear-tree culture. It has been only by persistent effort that the fruit-trees on the Department grounds have been brought to their present highly improved state.

The conditions of wood-growth most favorable to the development of pear-tree blight will form the subject of further investigations, with the view to assist the practical cultivator to counteract, if possible, this troublesome and so frequently fatal disease.

FIJI ISLAND COTTON.

The Department is informed by Mr. Isaac M. Brower, United States consul at the Fiji Islands, that sea-island cotton, which is an annual plant in the United States, becomes perennial in those islands, and that its growth is much more vigorous there than here, and that for a term of years there is a continuous crop from the same planting. He has plucked cotton from a plant five years old, but the fiber is defective in one particular, and is objected to by the Liverpool merchants. They informed him that they feared that Fiji cotton is subject to some form of disease which caused it to knot, a fault which may be seen with the naked eye. Mr. Brower placed a specimen in my hands for microscopic examination. I placed one of these knotty specimens on a glass slide, put on it a drop of gum-water, over which I next placed a glass disk, pressing it down and submitting it to a power of about 75 diameters. The nature of the knots, so called, became evident. The cotton fiber had, in consequence of an extreme twisting motion, become so intertwined that an artificial knot was formed. Mr. Brower stated, on seeing the nature of the knot under the microscope, that the present system employed to separate Fiji cotton from the seeds, viz, the use of *rollers*, is apt to draw the knotted fibers more tightly than would be the case if the cotton-gin were employed.

When water is poured from a pitcher it generally partakes of a spiral motion, sometimes from left to right, at other times from right to left. The spiral motion is modified by the form of the surface over which it passes. Were the mouth of the pitcher plastic, the spiral motion would modify its shape, bringing it into harmony with that motion; the tendency of the water to move in a spiral direction, so far as it had force to overcome the resistance of the plastic substance, would shape it in harmony with that tendency.

The animal and vegetable kingdoms exhibit many examples of organic bodies partaking of the spiral form; many varieties of shells display perfect tapering spirals, and generally they take the same direction, viz, from right to left, viewing them with their apex turned from us. There are exceptions to this rule; some have been found with the spiral thread winding from left to right. Many vines exhibit this tendency. It has been observed that persons who have suffered from headaches or from fever, frequently lose their hair. As a remedy, shaving of the head has been resorted to with good results. The hair grows faster, but it has been found to become wavy with a tendency to twist or curl when very frequently shaved during a term of years. The human hair differs from hairs on leaves in its mode of growth in some particulars. It has individual roots, and springs from under the epidermis. The hairs, or cotton threads, of the cotton-seed resemble, in some respects, the human hair. They spring from under the outer dark brown skin or testa, and individually exhibit root formation. When a section of the cotton-seed is examined microscopically, it is found to consist of three principal parts, viz, the outer coating or testa under which is situated a lining membrane composed of a series of double cells surrounding and inclosing the nucleus; from these cells the cotton fibers proceed. When a small portion of this series is combined with a little gum-water and

ground to a fine pulp, the cells, viewed with a one-eighth object-glass, will be magnified to about three-fourths of an inch in length. They are perfectly transparent and are seen to be banded near their centers. The cotton thread or fiber is supposed to be a flat ribbon, although, when examining several sections of the roots of the fibers, I was convinced that the fiber is a flat tube resembling a ribbon. The twisting tendency of the cotton fiber is well known, its flat shape favoring that tendency. If the fibers, when growing or passing from their cells, obey the law which regulates the motion of liquids, as pointed out, we can account in a measure for their twisting, and as the spiral forms of water issuing from an orifice are regulated by the pressure of water and shape of orifice, so may the tendency of the cotton fiber to twist depend on the pressure of the circulating fluids. The experiments of Hales and Burcks show that the pressure of the ascending vine-sap is sometimes so great that it will raise a column of mercury 38 inches. The pressure of the ascending sap of the cotton plant has not yet been examined. The ranker the growth, theoretically, the greater will be the tendency of the fiber to twist.

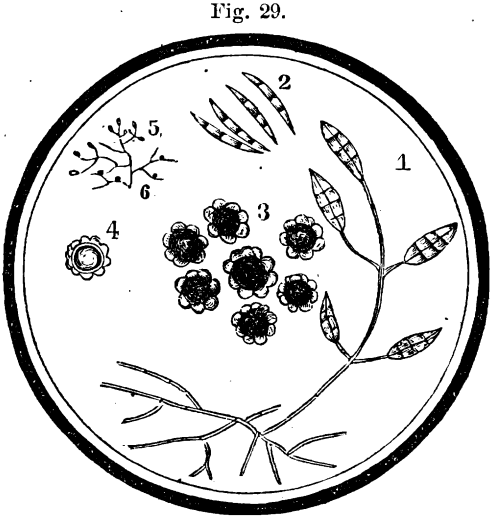
A series of microscopic investigations on cotton of various growths, quick and slow growing, might lead to some practical and valuable results. In the mean time I would suggest, as the most effectual remedy, the frequent renewal of the seed in the Fiji Islands.

Mr. Brower has notified the Department that he will take with him to Fiji, on his return, a quantity of fresh sea-island cotton seed, for the purpose of experiment as above suggested, and will report the results.

ONION-BLIGHT AND SMUT—(*Genus peronospora.*)

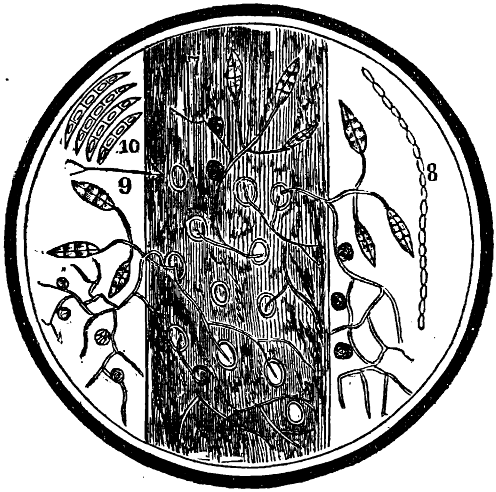
About the middle of August last I was invited by Mr. Benjamin P. Ware, of Swampscott, Massachusetts, to inspect a field near his farm, consisting of four acres of onions, which were badly blighted with fungi. The ground had been cultivated in the usual manner, and prime seed was used. At an early stage of their growth it was discovered that the onion fungus had diffused itself so generally over the field that it was deemed useless to cultivate it further. In the plot we found remnants of the crop, but very few onions had escaped the blight. The crop was practically consumed, causing a loss to the proprietor of about $2,000. I selected a few specimens of the blighted onions for experiment. The blight is first observed at the base of the leaves as a white mold, which ultimately spreads over the bulb, gradually blackening the surface, and penetrating through the layers. When a portion of the white mold found on the leaf is transferred to the microscopic slide, and viewed by a power of about one-eighth, it appears as at 1, Fig. 29. The spores seen

Fig. 29.



on the ends of the branches are compound, and when moistened resolve themselves instantly into separate sections, (2.) When the mold is matured, view by a power of about 75 diameters, it appears double-fruited, as at 5 and 6. It is believed by the farmers at Swampscott that dry weather favors the growth of the white mold, but that moist and rainy weather favors the growth of the black fungus, or rot, which is seen mostly on the bulb of the onion. When the black spores are viewed by a power of about one-eighth, they appear of a rosette form, (3,) each resembling a combination of cells, encircling a common center. Figure 30 represents at 7 a highly magnified view of a portion of the leaf of a mildewed onion; 8, a chain of elliptical spores, which grow in great profusion over it, when the leaf is kept in a moist condition for a few days; 9 shows stomates of the leaf from which thread-like mold, mycelium, is seen to proceed, proving that the fungus has ramifications under the epidermis, and doubtless through the intercellular spaces, if not through the cellular substance itself, from which the fungoid threads draw nourishment for the support of their fruit, &c. I subjected the black spores (3) to the action of concentrated nitric, nitro-muriatic, and sulphuric acids, caustic, potash, and lime, for twenty-four hours, without effecting any change in the structure. When immersed eight days in nitro-muriatic acid, the spores become slightly bleached, and appear as at 4. When immersed in heavy oil of tar, which contains a large portion of carbolic acid, their structure is materially changed.

Fig. 30.



In an address delivered by Mr. Ware before the Essex Agricultural Society, at Newburyport, September 29, 1869, he said that "The onion-blight and smut is at times very destructive to the onion crop, turning the most promising fields in a few days to scenes of desolation, which is caused, in my opinion, by a parasitic plant, growing upon and consuming the vitality of the onion. The onion-smut so impregnates the land with its spores, as to render it unsafe to plant onions for several years on land thus affected. White blight comes upon the crop at the period of its most vigorous growth, in a dry time, showing its effect perhaps in a small spot at first, but, in case the dry atmosphere continues, rapidly spreading over the whole field. Two or three days give sufficient time to stop entirely all future growth of the crop, unless a change in the weather occurs unfavorable to the growth of the parasite."

When an onion affected with fungus is placed in a vessel with a few drops of water and exposed to a temperature of about 75°, its decay is hastened very materially, but apparently more from the presence of infusorial life than from the parasitic fungi. The latter seem to prepare the way for the development of a species of angulula, which appears in great numbers, also, monads, water-mites, vibrions and bacteria, by breaking up the proximate elements. These being destroyed, or changed

in composition, a watery juice is always formed where the fungi rested. Whenever the conditions are favorable for aquatic life, it appears in profusion. This explains the cause of its rapid decay in the field, when once attacked by "mildew and smut," under high temperature and moisture.

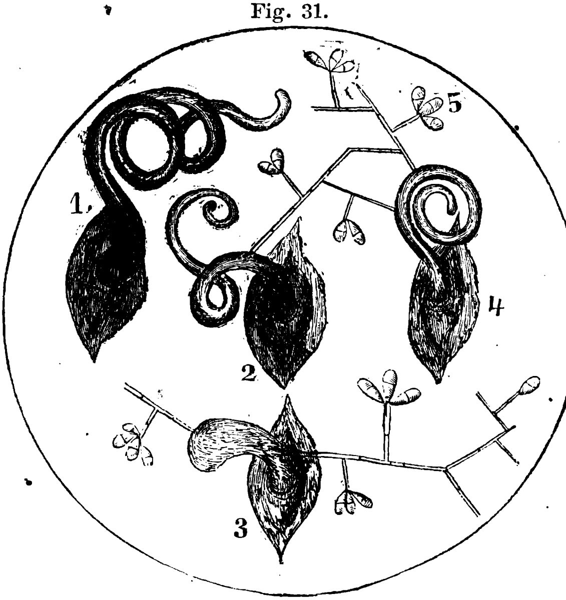
Moisture, and a temperature of about 70°, seem to have the effect of changing the sectional spores from their original appearance, as represented in Fig. 18, 2, to that in Fig. 19, 10, in which a greater number of divisions is observed, containing sometimes as many as eleven cells, and all containing slightly elliptical spores. To ascertain the true course of the transformation of the onion-blight and smut will require further observations; but I think it probable that the so-called smut is but a higher stage of the secondary globular yellow fruit seen on the mycelium. See Fig. 18, 6. The micro-chemical observations made fully sustain the views of the onion-growers, viz, that the onion-smut is very tenacious of life.

In many localities, rank weeds might be procured in great abundance on fields infested by the fungi, (on the field alluded to, weeds three feet in height grew in profusion;) were they cut down, sun-dried, spread over the field, and with them brushwood and all useless materials found about the farm burned, the surface-spores, and all germs of a parasitic life within reach, would be consumed, and caustic potash, lime, and charcoal would be liberated and diffused over the field for the benefit of the succeeding crops.

YELLOWS OF THE PEACH.

On the 1st ot July last I commenced a series of experiments by the moist process with the bark of a peach-tree affected with the yellows. Into five glass receivers I placed respectively, a few drops of water, just sufficient to form a moist atmosphere in each. Into No. 1; I put a piece of bark affected with the yellows; into No. 2 a piece of bark from a healthy peach-tree; into No. 3 a handful of peach-leaves from the unhealthy tree; into No. 4 a similar quantity from the healthy tree; and into No. 5 portions of bark from the healthy and unhealthy trees mentioned. All the specimens were secured from the outward atmosphere. The temperature of the room in which the specimens were kept was frequently at 90° Fahrenheit. These conditions were highly favorable to the development of such fungi-germs as mature under excess of thca and moisture. Previous to arranging the specimens in the re-

Fig. 31.



ceivers they were examined minutely with a low power, but no signs of fungi were visible. On the 15th day the unhealthy specimens in Nos. 1 and 5 exhibited on their external surface a spotted appearance. When viewed by a power of 75 diameters they were seen to consist mostly of a translucent, yellowish-brown, spiral, thread-like fungus, genus *Næmaspora.*

In Fig. 31, 1, 2, 3, and 4, represent the spiral stages of this fungus. When a portion about .03 of an inch is placed under an object-glass of one inch, and secured in the usual manner by means of a disc, with dilute gum-water, the spiral forms are seen to dissolve gradually, and ultimately to form a yellow stain. On viewing it with a power of one-eighth, it appears to be a mass of curved spores, resembling in form caraway seeds, but invisible to the naked eye. Each spore has a life-like motion confined to a center of its own. When they are treated to the action of nitric, muriatic, and nitro-muriatic acids, no immediate change is observable; and in those strong acids the life-like motion continues, which, I think, proves that the motions are not the result of any form of organic life, but simply what is known as "Brownian motion," which is frequently seen when minute particles of inorganic matter are placed under a high power. When the spores are combined either with concentrated sulphuric acid or caustic potash they become completely destroyed, forming a homogeneous mass, and their organic structure is no longer visible.

Fig. 32.

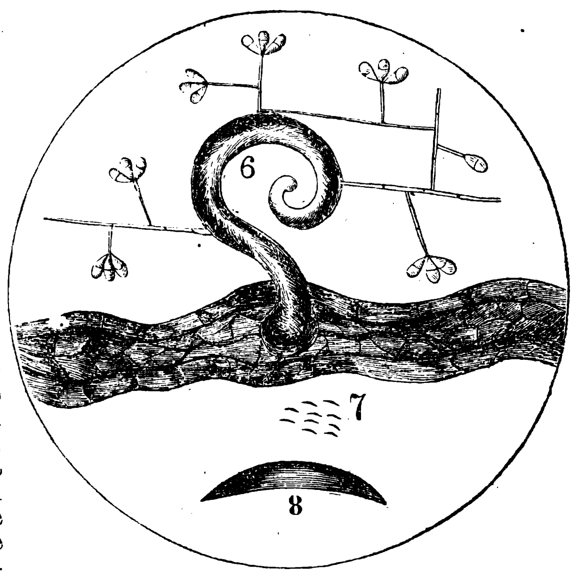


Fig. 32 represents a sectional view of the bark; 6, *Næmaspora;* 7, the same, when placed in water or acid, except sulphuric; 8, a very highly magnified form of the spores contained in 6.

About the 20th day mycelium was found in abundance growing from the spiral threads, (see 5,) resembling double-celled *Puccinia,* the spores varying in number from 1 to 10, and so small that a power of one-eighth was required to give good definition. Since contact with water dissolves this form of *Næmaspora* without destroying the life of the spores, it is evident that the action of rain or washes of pure water will only tend to diffuse the spores over the body of the tree and roots, while the applications of solutions of sulphuric acid and alkalies will destroy them. Hence a remedy may be found for peach-yellows in the application of alkalies and sulphates, and their compounds, to the bark and roots of the trees. Statements have frequently been made that the application of hot lye has been known to cure peach-yellows when applied to the

bark and roots. My observations seem to confirm these common rumors.

In receiver No. 5 the healthy bark was not contaminated, seemingly, with the *Næmaspora*, notwithstanding its immediate contact during several weeks with the unhealthy bark. As might be expected, the common molds, *Penicillium* and *Mucors*, grew all over the surface of the specimens, healthy and unhealthy. The leaves in Nos. 3 and 4 were next examined. They had been subjected to the same treatment as the bark. The healthy leaves, although confined during four weeks in a moist atmosphere, at a temperature ranging from 80° to 90°, exhibited no signs of mildew. A split branch to which the leaves were attached exhibited a small portion of *Mucor* fruit, and *Mycelium* on the sapwood and pith; but the unhealthy leaves were completely covered in two weeks with *Mycelium*, (mold,) and the fruit of the common blue, yellow, and black *Penicillium* and *Mucors*. I have repeated these experiments several times, always with the same results. It is evident that the healthy leaves possess an antiseptic substance, which prevents the growth of the common molds on them. A portion of healthy and unhealthy leaves from the trees above mentioned was analyzed in the laboratory to determine the respective amounts of moisture, organic matter, and ash in them, and gave the following results:

Healthy peach-leaves:	
Moisture	29.20
Organic matter	63.22
Ash	7.58
	100.00

Unhealthy leaves:	
Moisture	36.9
Organic matter	59.4
Ash	3.7
	100.00

The fact of the absence of ash or solid matter and of the increase of moisture in the unhealthy leaves, would of itself account for their greater tendency to mold. Since leaves do not absorb earthy matter from the atmosphere, it is evident that the cellular structure of the tree has in some way failed to perform its functions; for, had the ascending sap carried with it potash, lime, or other earthy matter, the leaves would have been stored with them, since the leaves have no power to evaporate them. The deficiency of earthy matters in the leaves may also account for the absence of ash in the fruit. If the theory is well founded that the leaves elaborate juice for the growth of the fruit, the leaves being deprived of proper nourishment, the fruit cannot mature. It has been long observed that trees affected with the yellows fruit earlier and mature prematurely, and soon decay. The presence of a larger amount of sap in the unhealthy than in the healthy, indicates an earlier and greater flow than in that of the healthy tree. The presence of watery sap in the leaves, twigs, and buds would induce naturally an early growth of fruit and premature decay. From these and other observations the disease seems traceable to the body of the tree or roots. Applications of washes in this case to the leaves would probably prove useless, but if applied to the bark and roots might prove curative; and for that purpose, judging from microscopic observations, I would recommend the frequent application of hot lye as the best substance.

J. M. Asher, of the Fruitvale Nursery, Paradise Valley, National City, California, writes to the Department under date October 28, 1872, as follows: "One of your writers suggests lye as a remedy for yellows of the peach trees. Our soil in California is more or less impregnated with alkali, and I never have seen a case of yellows in the State."

POTATO BLIGHT AND ROT.

The potato-disease was first observed in Germany, near Liège, in 1842; in Canada in 1844, and in England in 1845. In the following year it prevailed very extensively over almost all parts of Europe. The summer was unusually cloudy and moist, a circumstance which doubtless had great effect in fostering the disease. It has been estimated that the damage sustained by Great Britain and Ireland in the year 1845 was not less than £21,000,000, and in 1846 probably twice that amount. The London Times estimates that the loss sustained by Great Britain during the present year, in consequence of this disease, will be from twenty to thirty millions sterling.

For thirty years past the potato-rot has been attributed to a parasitic fungus, known as *Botrytis infestans*, but the recent microscopic researches of Dr. Payen have resulted in the discovery of a form of fungus in the diseased potatoes not heretofore observed. It is thought, however, by Berkeley and others, that the new form detected by Dr. Payen is probably a secondary fruit (*oospore*) of the *Botrytis* itself, the habits of which are not yet fully understood, although many of the ablest investigators of Europe have for years past been devoting more or less attention to the subject. It has been observed that the fungus attacks the stalks, first causing brown blotches. The disease is next transmitted to the tubers. If we take a withered stalk, which has decayed in consequence of the fungus, it will be found that the brown markings have ripened into forms similar to those discovered by Dr. Payen; and if a longitudinal section of the stalk is made, it will be seen that the interior is also covered with these spores highly matured and generally connected with a very slender jointed light-brown *mycelium*. The dark rounded forms are visible to the naked eye, but when viewed under a power of fifty diameters they appear to vary in size, although with this power they generally appear to be about the size of a large pea. Some are elongated, and all are of a very dark-brown color.

Fig. 33.

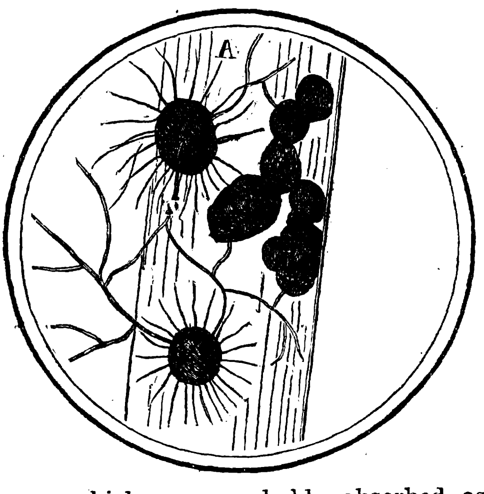
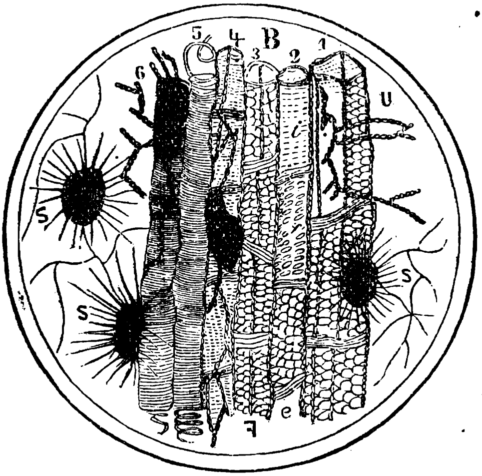


Fig. 33 represents various fungoid conceptacles which I have found on the interior of the stalk. When highly matured they are covered with dark-brown, rigid, thorn-like appendages, having a slightly wavy appearance.

Fig. 34. B represents a longitudinal section of the stalks; 1, 2, 3, 4, dotted ducts; 5 and 6, spiral ducts; 4 and 6 are represented as being choked up by means of budding spores, which were probably absorbed as

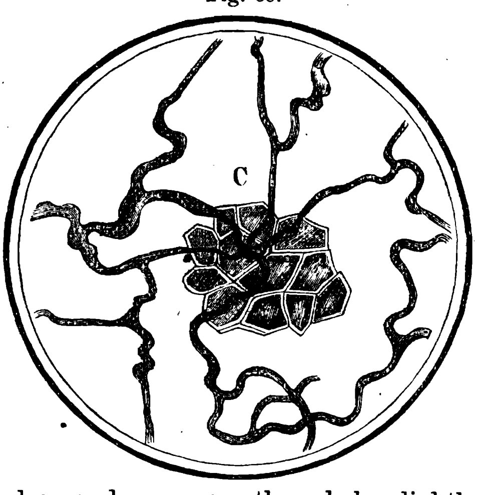
germinal matter and matured as represented into well-defined cellular structures. Their enlargement by the mere process of budding would tend not only to fill up the whole air-space, but also to burst the cell-walls, destroying the functions of the plant; U, budding-cells passing through dotted duct-cells; S, S, S, S, the newly discovered fungi-fruit, (conceptacles.)

Fig. 34.



The true mechanical structure of the dotted ducts can only be seen when they are highly compressed. A sectional view of them is shown at 1. They are pentagonal, (five-sided.) When not compressed they appear dotted, as at *i*. When slightly compressed, as at *f*. When highly compressed, as at *e*. They are composed of a lace-work, the openings of which are doubtless covered with a membrane of very transparent cellulose. The whole structure is calculated to give great strength with great porosity. Another peculiarity connected with the dotted ducts is worthy of mention. On each angle of the duct a series of very small elliptical cells extend lengthways, as represented at 1 and 3, F, giving the ducts great rigidness. These peculiar markings, independent of their uses, are of great value to the microscopist in assisting him to distinguish their relation in minute leaf-buds, &c. In some cases, when tracing the position of spiral and dotted ducts, requiring high powers of the microscope, I have found it difficult to distinguish one from the other, without destroying the cellular matter surrounding them, which frequently is not desirable; but with a knowledge of these markings the distinction is easily made. With a "section-cutter" make a very thin slice of a potato, cutting through the eyes, subject the slice to the action of concentrated nitric acid about five or ten minutes. The starch will become transparent. Next place the slice on a microscopic glass slide of sufficient size to hold the whole section, place a few drops of gum and glycerine compound on it, over which lay a thin glass and compress the whole slightly; adjust the specimnes properly under a power of from 75 to 200 diameters, when the vascular bundles will be found to be connected with the eyes of the potato. Similar examinations of sections cut at different points will demonstrate

Fig. 35.



the fact that these vascular bundles form a complete sphere, at a depth of about from one to two eighths of an inch below the surface, enveloping the whole interior portion of the potato, and connecting with the outer surface at every eye. If fungoid spawn (*mycelium*) or spores are contained in the spiral or dotted ducts which form these bundles they will be visible, as the acid will not affect either the ducts themselves or the fungus.

Fig. 36.

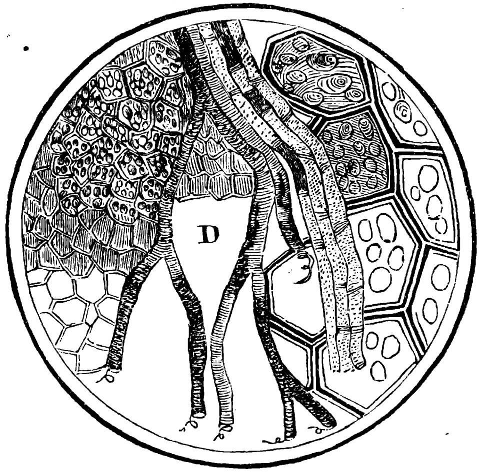
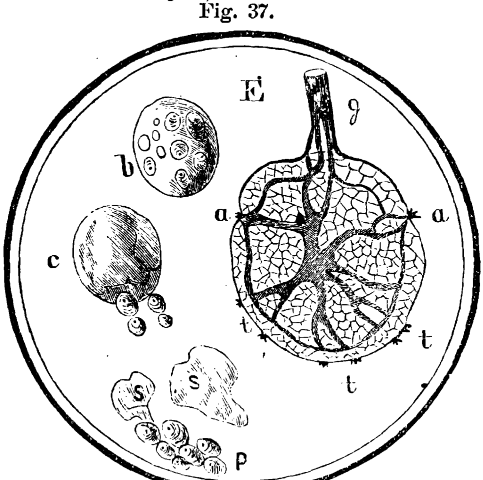


Fig. 35. C represents a highly magnified interior view of the cells of the skin of an affected potato, traversed by a dark jointed amber *mycelium*. I have not been able to detect any form of *mycelium* traversing the potato-cells, except on the interior surface of the skin; but judging from the habits of *mycelium*, I doubt not that it may be found traversing the interior of the vascular bundles of potatoes highly decayed, as described by Dr. Payen.

Fig. 36. D exhibits the appearance of a section of a potato showing the starch-cells and vascular bundles, dotted ducts, and spiral ducts intermixed. The largest cells shown are very highly magnified, in order to exhibit their real structure. The pentagonal lines, which will be observed inclosing the starch granules, represent a section of three distinct cell-walls, one within the other. The interior, or third cell, contains the starch.

Fig. 37 exhibits a section of a potato; *g*, the root-stem; *a a*, sections of eyes; *t t t* exhibits the position of other eyes, but not in section. It will be seen that the inner markings exhibit a series of central circular and radiating lines leading from and returning to the root-branch *g*. These lines represent the arrangement of the vascular bundles of the potato. When a potato is cut in two sectionally, lines will be exhibited as shown, especially if a "pink-eye" potato is used; and, if exposed to the action of the air for a short time, the nitrogenous matter in the immediate vicinity of the vascular bundles blackens. I have stated that the starch is inclosed in three cells. They consist of, first, an outer cellulose transparent cell; secondly, an opaque nitrogenous cell or lining; and thirdly, an inner cell, composed of very transparent cellu-

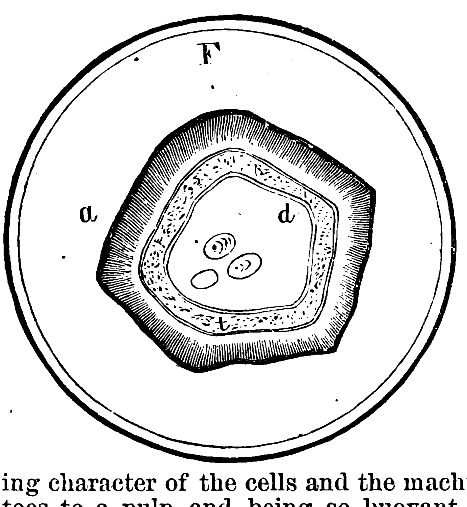
Fig. 37.



lose, in which the starch-granules grow; *b* represents such a cell. These cells contain from thirty to seventy granules. *c* represents a broken cell, from which the starch is seen as if in the act of leaving; *s* represents a portion of a broken cell; *p*, precipitated starch. The starch-granules, individually considered, consist of the starch proper and a cellulose covering or cell.

On receiving some diseased potatoes from Mr. B. P. Ware of Swampscott, Massachusetts, under date November 1, 1872, I commenced a series of experiments on them, having in view the detection of the mode of action of the fungus on the nitrogenous matter of the potato and other considerations. I arranged five vessels as follows: into No. 1, I put a strong solution of sulphate of copper; into No. 2, a dilute solution of sulphite of soda; into No. 3, the milk of caustic lime in excess; into No. 4, a very dilute solution of carbolic acid in water; into No. 5, pure water. I placed in each solution half of a diseased potato. The following will show the action and results after six days' saturation: The potato in No. 1 solution was found to be perfectly preserved and deodorized, so that it could be sliced into sections, and preserved for future use. No. 2 solution failed to preserve, deodorize, or prevent the destructive action of the mycelium of fungus, contrary to expectation. No. 3 destroyed the odor on application, but in two days the lime became completely carbonated, forming a mass of chalk, when the offensive odor appeared again, and decomposition of the nitrogenous cell went on as if lime had not been present, and infusorial life, in the form of *bacteria*, appeared in great numbers. No. 4 specimen was preserved completely. In No. 5 specimen decomposition seemed to have been slightly retarded at first, but the decomposition on the third day was in full action, and the odor became very offensive before the sixth day. When a portion of No. 3 was placed on a microscopic slide, and secured by means of a glass disk, and viewed under a power of about 75 diameters, masses of starch-grains appeared in cellulose cells all over the field, as illustrated by *b*, Fig. 37. A reference to Fig. 38, F, will show the position of those cells, *a*, *d*, *t*. They are held in position in the potato by the nitrogenous cell *t*, which is held in turn by an outer and inner cellulose cell, *a*, *d*. When a sound potato is grated down, all these cells are broken, because of their perfect cohesion to one another. One cell cannot be broken without breaking all. But in the case of rotting potatoes, the nitrogenous cell which binds the three together is partly removed by the fungoid action, but principally by infusorial life (*bacteria*) which live on it. The inner or center cell containing the starch is thereby liberated. This is owing partly to the soft and yielding character of the cells and the machinery used in reducing the potatoes to a pulp, and being so buoyant as to float the starch-granules within them, are carried away in the process of washing as stated. Dr. Payen, as early as 1846, in a paper read by him before the Paris

Fig. 38.



Academy of Sciences, stated that the starch of fungoid potatoes is not injured, and during the present year Dr. Hooker, of Kew Gardens, London, has, after a microscopic examination, made a public statement to the same effect.

Starch manufacturers, on the other hand, have stated in the columns of the English scientific monthlies that, while they do not deny the statements of these scientists, they affirm that a large portion of the starch of the rotting potatoes will not sink and is washed away. The results of my investigations, as above described, will, I think, sufficiently explain the discrepancy between the savans and the manufacturers. To subject the matter to a practical test I placed a portion of the rotting potato in a muller and ground it into a very fine pulp, thereby rupturing the third cell. I next placed the pulp in water. After twenty-four hours I examined, microscopically, the precipitate and the whitish matter floating in the column of water. I found the whitish substance to be cellulose, or broken cells, while the precipitate was pure starch, showing that the starch had escaped from the cells by the extra friction. Mr. Martin McKinzie, of Boston, Massachusetts, wrote to the Department under date November 1, 1872, stating that, in a field near his residence, Early Rose and Jackson White potatoes were planted last season, adjoining each other; the first, or Early Rose, proved nearly an entire failure from blight-fungus; while the second, or Jackson Whites, grew to perfection. Not the slightest appearance of blight was manifested in any instance on them. The writer further states that the conditions of planting, manuring, and soil, were practically the same in each case. Facts similar to these have been collected from time to time, and form an important point for further observation. They indicate a strong probability that the disease may be due to the condition of the potatoes used as seed. It has been frequently stated "that the potato, from high cultivation, has run out, and that recourse should be had to the seed of the plant as a means of renewing the crop." The terms "high cultivation," if they have any practical meaning, must signify that an internal organic structural change has taken place. It may be that the vascular bundles, or air-cells, occupy a larger relative space in the highly-cultivated potato, so called, than they did when this vegetable first became an object of public interest; if so, this alone might in part explain one of the great causes of potato-rot. The fact that the disease in the potato always appears first in the vicinity of the air-cells, would seem to fortify this idea, and investigation in this line might prove profitable.

A superabundance of moisture and heat produces rank vegetable growth. The first structure formed consists of cellulose cells, which may include the vascular bundles and other forms of cellular tissue. Nitrogenous cells next follow as a lining to cellulose cells, and within these again form cellulose cells, which, in the case of the potato, contain the starch, and the more likely is this the mode of action from the fact that starch may be made from the nitrogenous matter, while the latter cannot be made from the former. It is evident that the Jackson Whites, in the case alluded to, were proof against the attacks of fungi, although surrounded by them, and the inference might be drawn that the seed of the Jackson Whites was in a more favorable condition when planted than was that of the Early Rose, and hence the assimilations of the plants were not retarded. The savans of Europe, according to the English monthlies, have nothing better to offer as a remedy than the cutting off the stalks the moment the brown blotches appear. This may be the best mode of preserving the tubers as an article of food, under the circumstances; but in the absence of stalks, leaves, and the healthy

action of light and air on them, the tubers will not attain a healthy and consolidated growth, and the use of such for seed will increase the tendency to premature decay, and to the attacks of the potato fungus, *Botrytis infestans*, which is always present in damp places on plants of the natural order *solaneæ*, but never on any plant not of that order.

The mechanical and chemical properties of the soil in which potatoes are planted should be also considered. Potash has the property of absorbing and retaining moisture in a high degree, and will thereby tend, when present in excess, to keep it wet or moist, while carbonate of soda has the property of giving off water, that is, in a dry atmosphere. Soda effloresces; its crystals will lose in a dry atmosphere the greater part of their water on mere exposure to the air. These conditions should be especially considered when either of these alkalies is in excess in the soil, particularly when a soda soil is in contact with a very moist one; since they may have important effects not only on the chemical conditions of the potato but also on the growth of the relative proportions of the organic structure, such as the spiral ducts, parenchyma, nitrogenous, and starch cells.

The ash of potatoes which grew on a potash soil, according to Professor J. W. Harding, of Virginia, contains potash 52.5, soda .5. During the month of December last we had an opportunity of making a partial analysis of some samples of potatoes grown upon soil strongly impregnated with soda, (sent to this Department by W. F. Arney, secretary and acting governor of New Mexico,) and it was found that there was a strong predominance of the amount of soda present over that of the potash, showing the power of substitution, and suggesting the possibility of change in cellular structure in consequence.

I would recommend that when tubers in any locality have grown to a state of perfection *during epidemic periods*, as in the case of the Jackson Whites alluded to, a sufficient quantity of such should be selected for seed purposes and planted in still more favorable localities, and that this course should be continued.

INFLUENZA IN HORSES.

BY JAMES LAW,
Professor of Veterinary Sciences, Cornell University.

In presenting the following report on influenza, I beg to acknowledge my indebtedness to correspondents of the Agricultural Bureau for valuable information concerning the progress of the malady, and also to the various scientific men mentioned in the text, who have all responded promptly and heartily to any request for information or assistance.

While much that is of value has been secured, and especially on the question of the causation of the disease, I would respectfully submit that certain points require further investigation, and are yet capable of elucidation, inasmuch as the malady is still progressing and continually invading new territory.

I would refer especially to the observations on the amount of ozone in the air, and the disturbance of atmospheric electricity, both of which were remarkably in excess at Toronto in September, and the former at

Lansing, Michigan, during the visitation. By instituting a series of experimental observations at different non-infected places, as the Southern and Western States, including the Pacific slope, and continuing these until the disease is at its height, the question could be decided as to whether these are essential accessory causes. It has been sufficiently demonstrated that they are not the true specific causes.

Another point which wants elucidation is the inoculability of the disease, or its transmissibility, by transferring the blood of a sick animal into a healthy system. The limitation of the poison to the air passages, which the failure to transmit the disease by transfusion would seem to imply, would have a very important bearing on the question of prevention and treatment.

Definition.—An epizootic specific fever of a very debilitating type, with inflammation of the respiratory mucous membrane, and less frequently of other organs, having an average duration of ten to fifteen days, and not conferring immunity from a second attack in subsequent epizootics.

Synonyms.—The corresponding disease in man was known to the older physicians as *Peripneumonia notha*, *P. typhoides*, *P. catarrhalis*, *Pleuritis humida*, *Fidris catarrahlis*, *Catarrhe plumonaire*, *Catarrhus á contagio*, *Defluxus catarrhalis*, *Cephalalgia contagiosa*, *Rheuma epidemicuno*, &c. As seen in animals it has received the following designations: Epizootic catarrh, catarrhal fever, gastro-catarrhal fever, mucous fever, gangrenous peripneumonia, epizootic pleuro-pneumonia, entero-pneumo-carditis, epizootic nervous fever, distemper, *blitz katarrh*, rheumatic catarrh, *la grippe*, *cocote*, *typhose*, *septicœmio*, &c.

Past history.—The frequent co-existence of an epizootic catarrh in man and the horse, and to a less extent in other animals, lends some color to the hypothesis that they are due to closely-allied causes. The records of its prevalence in man might therefore be profitably referred to as illustrating the action of such causes at a time when veterinary records are few and imperfect.

Between 415 and 412 before Christ, Hippocrates and Livius report the extraordinary prevalence of catarrhal maladies in Greece and Rome, which Schuurrer and Hæser suppose to have been influenza. Diodorus Siculus reports an epidemic, apparently of the same kind, in the Athenian army in Sicily in 415.

Absyrtus, a Greek veterinarian, writing about A. D. 330, describes a disease in the horse having the general characters of influenza. This appears to be the earliest record of such an affection in the lower animals, yet the reports of epidemics at an earlier date almost necessarily imply the existence of the equine malady.

Passing over a number of epidemics, we come to the next recorded equine influenza in A. D. 1299. In this year a catarrhal epidemic spread widely in Europe, (Parkes.) The equine disease is thus described by Laurentius Rusius, as it prevailed at Seville: "The horse carried his head drooping, would eat nothing, ran from the eyes, and there was hurried beating of the flanks. The malady was epidemic, and in that year one thousand horses died."

Six epidemics of influenza are recorded in the fourteenth century, but among animals nothing more than an epizootic quinsy at Rome, from which Rusius, who reports it, lost fifty horses.

We have no distinct evidence of influenza in animals in the fifteenth and sixteenth centuries, though in 1510 and 1580–'81, during the prevalence of cattarrhal epidemics in Europe, animals suffered severely, from what disease is not stated, (Salius Diversus, Thomas Short.)

Solleysel describes an epizootic among the horses of the French army, operating in Germany in 1648, which closely agrees with influenza. It began by fever, great prostration, tears running from the eyes, and a profuse greenish mucous discharge from the nostrils. The appetite was lost and ears cold. Few recovered. This appears to have closely followed the epidemic influenza of 1647, mentioned by Hensinger.

In 1688 influenza was epidemic over the whole of Europe, spreading from east to west. In England and Ireland it was immediately preceded by a nasal catarrh, from which horses universally suffered, (Short, Rutty.) In 1693 it again prevailed over the whole of Europe and the British Isles, attacking first horses, and then, after a short time, men, (Webster, Short, Forster.) In 1698, during an epidemic catarrh in France, cattle and horses suffered from what was described as a bilious plague, (Bascom.) The year following influenza prevailed among horses in France, and severely among men and horses in England, (Webster.) In America in the same year horses were first attacked, and afterward men, (Forster.)

The year 1707, remarkable for an eruption of Vesuvius and the upheaval of a new island in the Ægean Sea, witnessed an epidemic catarrh in Franconia, (Steurlius,) and in England, where horses also suffered, (Short.) A similar eruption, with earthquakes, in 1712, coincided with an epidemic and above all an equine influenza, (Laucisi, Kanold.) In the winter of 1727–'28, horses in Great Britain suffered from epidemic catarrh; in Ireland it attacked man a little later, (Rutty.)

In 1732, seven earthquakes occurred in China, followed by pestilential diseases in man and malignant carbuncular diseases in animals. A little later influenza spread over Europe and America from east to west, (Glugo.) Arbuthnot and others who described it in England remarked upon the sulphurous vapors pervading the atmosphere, and that men and horses were attacked successively. Gibson, who furnishes a full description of the affection in the horse, says that it attacked mainly young or ill-conditioned animals, and did not prove fatal. In 1736 and 1737 it again prevailed in England, attacking men and horses. Short, who records this, mentions an eruption of Vesuvius in the latter year. In 1740, 1742, and 1743 violent sore throats prevailed in man, horse, and ox, (Huxham, Rutty, Faulkener;) but whether due to influenza is not plain. In 1746 and 1750–'51 catarrh was epizootic among horses in Ireland, (Rutty, Osmer;) in 1758 in Scotland and England, attacking man as well, (Whytt, Bascom;) in 1760, after an eruption of Vesuvius, influenza appeared in Great Britain, Ireland, and elsewhere in Europe, attacking first horses, then men, (Bisset, Rutty.) In 1760 it is reported as in Denmark, attacking horses and dogs; and in 1762 in France, Ireland, and other parts of Europe, among horses and men, (Rutty, Bottain.)

In 1767 it prevailed in Europe, and above all in England, where it attacked first dogs and horses, then men, (Forster, Iteunsen;) also in America among horses. It carried off almost all the young horses and colts in New Jersey, and was very ruinous in New England, (Webster.)

In 1776, after a very severe winter and warm summer, with an earthquake in Wales, influenza spread over Europe. Fothergill, Cumming, Glass, Haggarth, and Pultney, in England, and Lorry, in France, noticed that horses and dogs suffered before it attacked human beings. Huzzard speaks of the horses suffering last. Poultry died in great numbers from an epizootic with defluxions from the eyes. In 1780, after eruptions of Vesuvius and Etna, and a terrible earthquake in Taurus, influenza appeared among horses. Huzzard describes

it as seen at Paris. Gluge and Hensinger say that it broke out epidemically in September, 1780, in China, and, spreading over Asia, reached Moscow in December, 1781, gained Revel and Western Prussia in February, 1782, and Spain and Italy in August and September. Forster says it prevailed in America in the spring of 1781, and the following year in Europe. Haveman records an equine influenza at the same time in Germany, and Abilgaard leaves a monograph on the disease as it prevailed in the royal stud at Copenhagen. This year was rigorously cold all over Europe. In 1798 influenza again prevailed among horses in England, (Wilkinson, White.)

In 1800 influenza was said to have prevailed at Whampoa, in China, whence it was believed to extend over Asia, reaching Europe in 1802 and England in January, 1803, (Gluge.) Though in some places man alone appears to have suffered, in others horses fell victims as well, (Hensinger.) In 1814 this affection prevailed in horses in Switzerland, (Hensinger,) and 1815, in a malignant form, in England, (Wilkinson, Youatt.) It appeared again in an epizootic form in England in 1819, 1823, (Field,) and 1828, (Brown.)

In 1833 it extended over Europe from east to west, attacking men, horses, dogs, and even cats. It prevailed in Courland from January to March, (Possart;) in Pomerania and Saxony in April, (Rhodes, Prinz;) and in France in May, (Compte Rendu de l'Ecole, Vet. d'Alfort.) In England Mr. Hayes describes it as lasting from October, 1832, to March, 1833. It was a "catarrhal fever, joined with inflammation of the lungs and liver and trachea and œsophagus and larynx and pharynx, and the mucous lining membrane of the bowels, frequently with all the symptoms of malignant catarrh, and these in an aggravated form. In some cases there was excessive diarrhœa, the fæces were black liquid mucus, bloody and exceedingly fetid, and accompanied by such extreme debility that the animal could not move without falling; there was quick pulse, injected nose, mouth and gums as red and dry as possible, and resembling a piece of lean dry beef. In some there was excessive anasarca; in others phlegmonous tumors in different parts of the body; in others again there were spasmodic jerkings and lameness in the legs, shoulders, and hips."

In 1834 it is reported in Brandenburg, (Hensinger,) and in 1835 and 1836 in France and England, (Prinz, Veterinarian.) In the spring of 1845 it again prevailed in England, and in July became complicated by a severe inflammation of the eyes and dropsies beneath the belly and on the legs. (Veterinarian.) During the great influenza epidemic of 1847, it prevailed extensively among horses in Europe, and was unusually prevalent in England in the two following years as well. Since that time it has been especially prevalent in Great Britain, in 1851–'52, 1854, 1856–'57, in the early summers of 1862 and 1863, and in the latter part of 1871.

Past history of the influenza of 1872.—According to information received from Professor A. Smith, veterinary surgeon, Toronto, the first cases occurred in the townships of York, Scarboro', and Markham, about fifteen miles to the north of that city, among the last days of September. He says, "I think the first cases were noticed among horses running at pasture." Cases were seen in the city of Toronto by October 1, and in three days it had attacked nearly all the horses of the street-cars and livery-stables. On October 18 it was reported as general in Montreal and Quebec and throughout the Dominion.

Several Canadian horses were introduced into Detroit on October 10 or 11 suffering from what was supposed to be a catarrh. On arrival they

were at once placed in a large stable in the city, but almost immediately transferred to a smaller one to guard against the possibility of contagion. Two days later the disease showed itself in the horses occupying the larger stable, and in three days all of these were attacked. Meanwhile it had appeared in the smaller stable as well. No other cases are known to have occurred in the city until October 20, and soon after this it became general. Two of the imported horses were well enough to work from the first, and were constantly on the streets in the business part of the town.

On October 14 it was reported in Buffalo, New York, and was general by October 21. By October 17 Rochester had half its horses ill, and West Batavia had been attacked.

On October 19 it existed in Syracuse in newly-arrived Canadian horses; on the 22d one hundred to two hundred were sick in boarding and livery stables, and it spread with great rapidity in the country around.

As early as October 20 it was reported in Warren County, Pennsylvania; on October 21 at Depauville, Jefferson County, Attica, Wyoming County, and Steuben County, New York, and Keene, New Hampshire. On October 22 at Brooklyn, New York, Jersey City, and Boston. On October 23 it was prevalent at Newburgh and in the country round New York, in the towns situated on the New York Central Railroad, from Syracuse to Albany inclusive; in Hartford and New Haven, Connecticut; in Block Island, in Providence, and Newport, Rhode Island; in Lunenburgh, Vermont; in Bangor, Portland, and Augusta, Maine; in Washington and Carrollton, Ohio, and in Chicago, Illinois. On October 24 Lexington, Sanilac County, Michigan, and Baltimore, Maryland, were affected. On October 25 the first cases appeared in Oswego, New York, also in Clarkstown, Buckland County, and in Livingston County, New York; Westfield, Massachusetts; Lewistown, Bethel, Topsham, and South Parsonfield, Maine, (at the latter place, which is thirty miles from a city, the first case was a horse from a city stable, and a week later a colt in the same stable.) It was also reported at Corry, Pennsylvania, at this date. On October 26 it reached Sheridan, Chautauqua County, New York, and Pontiac, Michigan. On October 27 it attacked Glens Falls, Catskill, and Poughkeepsie, New York, and Rockville, Tolland County, Connecticut; in the last case it was supposed from Springfield, Massachusetts. On October 28 the Watertown street-cars were stopped, and the disease had just appeared at Binghamton, New York, Paterson, New Jersey, Philadelphia, Pennsylvania, and Washington, District of Columbia, October 28; in the last place in sick horses brought from the North.

On October 29 it was announced in Washington County, Vermont; in West Chester County, Port Jervis, and Carmel, New York; at Titusville, Pennsylvania, and Columbus, Ohio.

On October 30 it was reported for the first time in Peekskill and Nyack, New York. On the 31st it appeared in Little Genesee, in Rosendale, and Deposit, and in Ithaca, New York, having existed since the 25th in Trumansburgh, ten miles to the northwest of the place last named, and slowly reached Varna, three miles to the east of Ithaca, on November 6. Pittsburgh, Pennsylvania, and New Hope, Pennsylvania, were reached on October 31, the first of these places by five or six horses brought from New York City to the livery stables of Messrs. Moreland and Mitchell; the street-cars had to be stopped on November 5 for the lack of horses. Yet even up to this date Belmont's horses at Babylon, Long Island, and McDaniels's, at Saratoga, were still reported sound.

On November 1 it reached Kingston, on the west side of the Hudson. and Washington County, New York, attacking first the livery and canal horses, contrary to what occurred at Buffalo, where canal horses escaped until October 22. Is this difference to be accounted for by the fact that the canal did not extend into Canada?

At the same date it was reported at Germantown and Lancaster, Pennsylvania; Cincinnati, Bucyrus, and Etna, Ohio; Romeo, Michigan; Portsmouth and Chuckatuck, Virginia, and Newark, Delaware, starting in the last case with a horse just arrived from Baltimore, Maryland.

On November 2 it appeared at Adams, Massachusetts; on the 4th at Pittsfield; on the 5th at Great Barrington, and on the 6th at Richmond; all in the Hoosac Valley. On the same date it was observed at Charleston, South Carolina, in town and country at once.

On November 3 it broke out at Elyria, Ohio, confining itself for five days to teams which had been driven to Cleveland; at Goldsborough, North Carolina, and Columbia, South Carolina.

On November 4 it was reported at Springfield, Illinois, and in Lehigh County, Pennsylvania, where "it spread like fire along the canal and into the surrounding country."

On November 5 it was reported in Tioga, Elk, Chester, and Wyoming Counties, Pennsylvania, and at Grand Rapids, Michigan.

On November 6 it reached Cooperstown, Otsego County, New York; Greensburgh, Pennsylvania, and Richmond and Campbell County, Virginia; and on November 7 Butler County, Pennsylvania.

On November 8 it had attacked Montcalm, Livingston, and Ottawa Counties, and Lincoln and Tuscola, Michigan; Ravena, Ohio, and Danville, Virginia, where it prostrated 75 per cent. of the horses in twenty-four hours.

It was reported, November 9, in Hampton, Virginia, and two severe cases at Johnstown, Cambria County, Pennsylvania, where, however, it did not become general till the 24th, so that these must be considered questionable.

November 10 it existed in Sandusky, Ohio, on November 11, at Marshall, Michigan, Indianapolis, Indiana, and Savannah, Georgia.

November 13 it reached Scranton and Forest County, Pennsylvania, Hamilton and Marion, Ohio, and Wilmington and Tarborough, North Carolina, while it had reached its height at Louisville, Kentucky, and Milwaukee, Wisconsin, and was merging into dropsical and other fatal complications in Buffalo, New York, Baltimore, Washington, Philadelphia, and Raleigh, North Carolina.

November 14 it existed at Toledo, Ohio, and Lynchburgh, Virginia, and was nearly universal in Buckingham County and at Wheeling, West Virginia. November 15 it was reported in Mechanicsburg, Grampian Hills, and in Clearfield County, Pennsylvania, in Defiance, Ohio, and Madison, Wisconsin.

November 16, in Beaver County, Pennsylvania, and 17th at Cedar Springs, Clinton County, having traveled northward along the Susquehanna River. It had existed to the southeast and west for several days previously.

November 18 it broke out at Atlanta, Georgia, and Chattanooga, Tennessee. At Nashville, Tennessee, it broke out between the 15th and 20th, and spread slowly, so that exact figures are difficult to arrive it. At this time it prevailed in Giles, Rutherford, Maury, Davidson, and Sumner Counties, at points recently visited by a circus, which came from an infected district. At Memphis, Tennessee, it existed in a mild form on the 19th.

November 21 the street-cars in Augusta, Georgia, were stopped, and the first thirteen cases occurred at Martha Furnace, Blair County, Pennsylvania. November 24, fifty horses and mules were attacked at once at Johnstown, Cambria County, Pennsylvania.

November 27 the street-cars were stopped at Halifax, Nova Scotia, on account of the disorder; it was reported to be spreading rapidly in New Orleans; and had appeared in Jacksonville, Illinois, Keokuk, Iowa, and Montgomery, Alabama.

November 28 it was reported at Jacksonville, Florida; November 30 it prevailed in Fulton County, Georgia, and Newberry County, South Carolina, making a westward progress.

December 2 it broke out in East Saint Louis, Missouri; December 3, in Boonville, Missouri, and Omaha, Nebraska.

December 7 it reached Havana, Cuba, attacking native and northern horses alike. On December 14 it had reached its height, many horses were dying, and Mexican horses were being imported by the Spanish government.

The outbreak has varied widely in its nature at different places. Sometimes it has spread slowly along the course of railroads or turnpikes, and its progress can be very satisfactorily connected with the intercourse between the different places attacked. In other cases it appears, from the reports, to have struck down a whole city or limited district in twelve or twenty-four hours, and in a manner which it appears impossible to account for otherwise than by some subtle and generally pervading influence. The earliest reports of the disease from many points allege that colts, mares, and other animals, running at grass, have escaped, but later intelligence seldom or never fails to report their sickness. So, too, at Scranton and other mining regions in Pennsylvania the mules working underground kept well for about six days after those on the surface were suffering. The majority of the reports testify that animals at grass in mild weather were later in being attacked, and suffered less than those in regular work and stabled. Yet some report that those at pasture and away from all other horses suffered as early and as severely as those in-doors.

The percentage of horses attacked has been variously stated at from 80 to 99. As the reports are mostly written before the disease has quite passed away, it is probable that the latter number is nearest the general average.

The fatality appears to have been from 1 to 2 per cent. on a general average, though it has been considerably higher than this in some of the larger cities. The highest reported was at Farmingdale, New York, where it was claimed that 10 per cent. of the heavy horses had died. This was, however, drawn from too small a number of cases to be of any value as an average.

SYMPTOMS AND COURSE.

Incubation.—From the analogy it bears to other fevers influenza would be expected to possess a period of incubation, during which the poison which had obtained access to the system should remain there apparently dormant and without giving any outward sign of its presence, but really undergoing a process of rapid multiplication and establishing its hold on the animal economy. The duration of such incubation has not been definitely ascertained, the disease not having been transmitted by experimental inoculation; but, from the observation of cases in which it has appeared in a stable after the introduction of a sick animal, it is supposed to extend from one to three days.

SYMPTOMS OF THE SIMPLE OR CATARRHAL FORM.

First stage.—The extreme suddenness of the attack is among the most remarkable features of the malady, and one which obtained for it the name of the *lightning catarrh* (*blitz-katarrh*) among the Germans. It often makes its onset with a sudden and extreme prostration, with intense muscular weakness and drowsiness. A horse in apparently robust and vigorous health is seen with drooping head, ears, and lips, semiclosed eyelids, expressionless countenance, and one or two legs partially flexed, as if to seek relief from his weariness. He stands in one position, or if urged to move does so with reluctance, sluggishness, and often with unsteady, swaying gait. The back is arched and rigid, the limbs carried stiffly, and the joints often crack. At the same time there may be noticed a dry staring coat, a tenderness of the skin when handled, a tendency to coldness of the nose, ears, and limbs, and in exceptional cases shivering, tremors, or even nervous jerking.

A cough is always an early symptom, and in the visitation of 1872 it has been usually the first observed, as it was by far the most prominent of the early symptoms. It commenced as a short, dry, husky cough, frequently repeated, and for the first two days or more unattended by the extreme dullness and prostration above referred to. The temperature is raised to 102° F., the pulse is slightly accelerated and variable in character, but usually weak and easily compressed and rendered imperceptible by the pressure of the fingers. The state of the secretions further betrays the febrile state. The urine is less abundant and higher in color than natural; the dung often rather hard and glistening on the surface from the presence of mucus; the mouth is hot, dry, and clammy, and the mucous membrane of the nose dry and red or pink, with, in many cases, a tinge of brown or yellow, the color being common also to the membrane of the eye. The breathing is slightly accelerated, and if the ear is placed on the course of the windpipe at the lower end of the neck or on the side of the chest behind the middle of the shoulder, the blowing sound is heard louder than common. Thirst is increased and sometimes ardent, and the appetite usually slightly impaired or dainty, though in other cases unaffected.

Second stage.—As the disease advances other symptoms appear, and those first seen are usually aggravated. In some cases, indeed, there is no manifest aggravation, the spirit and appetite remaining good throughout, the prostration and fever are all along slight, the husky cough which heralded the disease becomes looser and gurgling or rattling, with the appearance of the discharge from the nose, and a prompt recovery follows as from an ordinary and slight cold.

But usually by the third or fifth day the cough has become deep and painful, occurs in paroxysms of four or five in rapid succession, and racks the entire body with the effort. The eyelids are swollen, and tears run from the eyes. A watery fluid distills from the nose, soon giving place to a thick yellowish or yellowish-green muco-purulent discharge. The temperature has risen to 105° F., the thirst intense; appetite variable, sometimes lost; pulse more rapid than natural, soft, weak, and easily excited by exercise; and the breathing somewhat deeper than before. The mucous membrane of the nose becomes of a deeper red until the discharge is freely established, sometimes almost purple, with patches of brown or yellow, and even *petechiæ*, or spots of blood staining in the worst cases. Swallowing is painful, the food being sometimes dropped from the mouth after it has been chewed. There is slight swelling and tenderness between the branches of the lower jaw and beneath

the roots of the ear. Handling the throat causes wincing, and easily excites a paroxysm of coughing, and the cough is softer and looser if a free discharge has been established from the nose. If the ear is applied over the windpipe or side of the chest, the former harsh blowing sound is found complicated by a rattle, (*mucous râle*,) and the hand applied on the side of the chest, just behind the left elbow, detects the forcible impulse of the heart with each beat. The loins are insensible to pinching in many cases. Unless affected by treatment the dung tends to become harder, firmer, and less abundant; the urine scanty and of a deep yellowish-brown color, or quite opaque from deposited lime salts. In many cases this liquid is thick and sizy, and all specimens which I have examined have shown a neutral reaction and contained albumen in variable proportions. I did not find casts of the uriniferous tubes in a single instance.—(See Dr. Caldwell's analysis of urine appended to this report.)

The supervention of a free discharge from the nose, the formation of an abscess about the throat, the occurrence of a profuse perspiration, or even a slight diarrhœa, if attended with a cooler mouth, a firmer, less rapid pulse, a lower temperature and a disposition to lie down, may be looked upon as critical, and is often followed by a prompt recovery.

Third stage.—This is the period of recovery, and is marked by the subsidence of all the morbid symptoms and the steady re-establishment of health. The cough becomes gradually less and less painful and no longer paroxysmal; the relaxed fatuous expression of the countenance ceases; the eye brightens; the spirits and appetite return; thirst diminishes; the discharge from the nose changes from a greenish to an opaque yellow or white hue, and is gradually dried up; the pulse acquires firmness; the impulse of the heart on the ribs steadily decreases, though still easily roused by excitement; the breathing gets easy, and strength and vigor are slowly restored. Considerable bodily weakness usually lasts after all other signs of illness have passed away; the horse sweats readily; flags if kept for some time at action or work, and is liable to relapse if overdone.

But all do not follow this regular and favorable course. Some exhibit a tendency to extreme violence from the first, and others, which begin mildly, soon show signs of dangerous disorder in the chest, in the abdomen, in the joints and muscles, in the subcutaneous connective tissue, or in the eyes. It is these complicated cases alone which are dangerous; the simple catarrhal affection always tends to a favorable termination.

With chest complications.—Even in the simple catarrhal form the respiratory mucous membrane is involved as far down as the lungs, but only in a slight degree. But in some cases the inflammatory action extends beyond the larger bronchial tubes, and invades their smallest ramifications, constituting the redoubtable disease known as a *capillary bronchitis*, aggravated by the debilitating fever of the influenza. The breathing becomes quick and difficult; the nostrils widely dilated; the flanks heave violently; the stupor and prostration are extreme; the mucous membranes are of a dark red or even purple hue; the cough deeper and more painful, the animal setting his feet apart, or perhaps even going down on his knees in his efforts to dislodge the cause of irritation; the blowing sound heard over the lower end of the windpipe is still louder and harsher than in the other case; and a loud wheezing is heard when the ear is applied over the sides of the chest. The patient stands constantly in this as in all the other complications in the chest, and the fact of his having lain down, and remained so for

some time, may be taken as a satisfactory sign of improvement. With this form the patient may literally die of suffocation, the thickened coats of the tubes and the accumulated exudation preventing the entrance of air to the air-sacs in the lungs. Or death may result from the increasing impurity of the blood, which renders it unfit to nourish and sustain the functions of the nervous system and other vital organs. Capillary bronchitis has been a frequent complication during the present epizootic.

If the inflammation extends to the lungs we have the typhoid pneumonia of medical writers, with a greater tendency to a liquid infiltration of the organ than to the firm consolidation (hepatization) characteristic of inflammation of the lungs in a more healthy system. In this case there is the same difficulty of breathing and the same general symptoms as in capillary bronchitis, but the wheezing sound heard over the chest is absent, or nearly so, and in place of this there is a fine crackling (crepitation) along a line circumscribing the inflamed portion, which itself gives out no sound. Percussion over the area which is destitute of murmur brings out a sound comparable to that obtained by striking a solid body, while the still previous portion gives out a more resonant or hollow sound than is natural. This may terminate fatally by complete infiltration of the lung tissue so as to unfit it for the function of respiration, by the destructive effect of extensive suppuration in its substance, by the exhaustion consequent on the excesssive drain on the vital powers, or by the increasing impurity of the blood, which finally becomes unfit to sustain the healthy functions. Short of this it may leave permanent lesions on the lungs, such as consolidation of a portion, with short wind, or impaired nutrition and innervation resulting in heaves and dilatation and rupture of the air-cells. In favorable cases the exuded lymph is entirely absorbed, and a healthy state of the lung is restored. In my experience this has been less frequent in 1872 than the bronchitic complication, and has occurred chiefly in animals which have been carelessly exposed when sick, or exhausted and debilitated by work, impure air, or injudicious drugging.

Pleurisy will sometimes supervene, though I have not met with a well-marked case during the recent visitation. Yet in other years it has been so frequent as to procure for the affection the name of typhoid pleurisy. This consists in inflammation of the membranes covering the lungs and lining the cavity of the chest. It is characterized, like the two last mentioned forms, by accelerated breathing, which is, however, short and catching, the inspiration being suddenly arrested by the sharp pain before the chest is quite filled. The spaces between the ribs at the affected part are excessively tender, and at this point in the early stages a slight rubbing sound is heard, caused by the gliding of the dry roughened surfaces of the inflamed membranes on each other. In twenty-four hours this may have passed because of liquid effusion into the cavity of the chest, and in such a case the natural murmur of the lung and the resonance on striking the chest are absent up to a horizontal line corresponding to the surface of the liquid, and this is usually at the same height on both sides. Death may ensue in this case from the accumulation of water so as to fill the cavity of the chest and prevent dilatation of the lungs with air; from the debility consequent on the abstraction of so large an amount of the blood elements from the circulation, or from decomposition of the effused products and general blood poisoning. It may cause permanent impairment of the wind, by the formation of fibrous bands attaching the lungs to the side of the chest, by compression of the lung through the contraction of a newly-formed fibrous envelope, or by injury to the recurrent laryngeal nerve. In favorable cases

an entire recovery may follow upon the absorption of all morbid products.

The pericardium or heart-sac is often involved in cases of pleurisy. All this is characterized by extreme tenderness of the chest behind the left elbow, a friction sound heard at the same point until effusion takes place, after which the heart-sounds appear more distant and indistinct. The action of the heart is often irregular throughout.

In other cases the lining membrane of the heart and its valves are the seat of disease, though usually as a complication of the rheumatic form of the affection. In this case there is irregularity of the force and intervals of the heart-beats, and the healthy heart-sounds are modified by sighing, hissing, or purring murmurs, coincident with the first or second sound of the heart-beat according to the particular valve diseased. There is breathlessness and tendency to dropsical effusions, coldness and weakness of the limbs, and a liability to faint on slight exertion. Clots of blood sometimes form on the diseased valves, or even independently of their disease in very impure conditions of the circulating fluid and weakness of the circulation, and give rise to the same class of symptoms or aggravate those already in existence. In all such cases there is great liability to sudden death, and this liability may last indefinitely even after apparent recovery.

With abdominal complications.—There is almost always some implication of the digestive organs, as evinced by the coated appearance of the dung, the yellowness of the mucous membranes, and the dangerous susceptibility to purgatives. So small a dose as two drachms of Barbados aloes has been known to prove fatal to the horse in influenza. Many cases during the recent epizootic merged into a muco-enteritis after the nasal catarrh had been already established, and in some visitations this implication of the digestive organs has been rather the rule than the exception, and the disease has been accordingly termed bilious fever, typhoid fever, gastric fever, &c.

In such cases, however, the disease usually makes its appearance as the simple catarrhal affection, and it is only after the discharge from the nose has been established that the muco-enteritis sets in, and by the violence of its manifestations virtually supersedes the original disease.

There is great torpor and stupor, and tension of the abdominal walls, which are generally tender to the touch, but especially at points occupied by the organs particularly implicated. Thus with derangement of the liver, and the more purely bilious symptoms, the tenderness is mainly over the short ribs on the right side, while with intestinal disease it is more uniformly distributed over the abdomen. The loins are insensible to pinching; there are colicky pains, with frequent looking round to the flank, or uneasy movements of the hind limbs, ardent thirst, clammy, slimy mouth, a coated or furred condition of the tongue, and unusual yellowness of the visible mucous membranes and of the urine. The urine is sometimes reddish or bloody, and passed with considerable effort. The pulse is small and weak, but with a quick beat and variable in number; the breathing is often quick and catching, as in pleurisy; the cough is weak and painful; the bowels show a tendency to constipation; the pellets of dung are thickly coated with mucus; and the membrane of the gut exposed in passing it of a dull red color. The anus will sometimes remain constantly open, air being alternately drawn into the gut and expelled. The animal strains frequently, but passes only a few pellets of dung at a time.

Improvement is often manifested in connection with a fever action of

the skin, kidneys, or bowels, the torpor and prostration disappear, the appetite and strength are increased, and a prompt recovery may be expected.

In fatal cases the torpor and prostration are augmented; the breath becomes fetid; the anus more puffy, red, and with a greater tendency to remain open; the dung passed often and in small quantities, soft and mixed with glairy reddish or bloody matter. The urine is scanty, high-colored, slimy, sometimes thick and gelatinous, fetid, and even bloody. The pulse becomes more and more rapid and weak, the eyes sunken, the surface and extremities become cold, the hairs are easily detached, and the stupor and debility extreme.

Complication in the joints, muscles, and connective tissue.—Rheumatic manifestations.—The stiffness of the body and limbs, and the general soreness in many cases, even at the outset, show how commonly the white fibrous tissues of the joints and muscles are implicated. It is only requisite that these symptoms should be unusually prominent to make the rheumatic feature of the complaint its characteristic one; and this has often been the case to a large extent in the colder latitudes, such as Northern Germany, Denmark, and Scotland. It has been a frequent complication in New York during the influenza of 1872. Cases of this kind mostly begin by showing the symptoms of the simple catarrhal malady, and often after this has made some progress in a regular, and it may be exceptionally mild form, there suddenly appears painful inflammation, with more or less infiltration and swelling of the fibrous sheaths of the muscles and tendons and of the ligaments of joints. There may be merely some swelling and tenderness of certain muscles of the face, neck, back, or limbs, or there may be thickening and shortening of the tendons and ligaments leading to distortion, and knuckling over at the knees and fetlocks, or liquid effusions may take place into the joint capsules, resulting in puffy, elastic swellings in different parts; the bones even may be involved in the disorder, or, worse still, the fibrous structures and valves of the heart. Dropsical effusions take place in some such cases from the impairment of the local nutrition processes, and weakness of the circulation, and even at times from the implication of the heart. Though the majority of rheumatic patients will entirely recover with proper care, yet a certain proportion only do so with stiffened limbs and joints, or with incurable disease of the heart, which subjects them to constant danger of fainting and sudden death.

Dropsical complications.—As already noticed, dropsical effusions sometimes ensue from pre-existing disease of the heart or suppressed secretion of the kidneys. In other cases they appear due to extreme weakness of the circulation and nutritive processes, and a watery or very impure state of the blood, the result of protracted or severe illness, unwholesome conditions of life, overwork at too early a stage of convalescence, and the like. Such œdematous swellings of the limbs, beneath the chest and belly, and in the lower part of the head, have repeatedly occurred as a prominent feature of the influenza in England, and notably in 1751, and July, 1845, apparently in connection with the extremely variable and unwholesome weather which prevailed. The dropsical cases in 1872 have been virtually unknown in this country, having been confined to Buffalo, Rochester, New York, Philadelphia, Washington, and other large cities, where the patients were in many cases condemned to draw overloaded street-cars, or other vehicles, as soon as the nasal discharge had been freely established and the fever had begun to decline; or when they were confined to damp, close, reek-

ing, unventilated, often underground buildings; or where they had been worn out by injudicious and exhausting treatment.

These dropsies are always dangerous, implying as they do extreme exhaustion and prostration of the vital powers, saturation of the blood with waste and hurtful elements, the product of the extensive waste of the body or complications on the part of the heart or kidneys.

Nervous complications.—The extreme muscular weakness and the occasional semi-comatose condition of the patient imply a profound prostration of the nervous centers, a condition which is, however, present to a variable extent in nearly all specific fevers. This has sometimes in the recent epizootic amounted to twitching of the muscles of the face, neck, body, or limbs, and has been known to result in delirium, and even partial or complete loss of control over the limbs. My friend and former collegian, Mr. Murray, of Detroit, has met with but three cases of extreme nervous disorder out of five hundred patients during the recent epizootic. Two of these he diagnosed as serous effusion into one ventricle of the brain, and one was a case of complete *hemiplegia*.

Inflamed eyes as a complication.—Rutty informs us that this was an almost constant accompaniment of the influenza in Ireland in 1760, and that many of the horses were left permanently blind. In that of 1845, in England, the affection of the eyes was again a prominent feature. Few cases lasted over a week, but the ophthalmia often persisted long after all other symptoms had passed away. In nearly all epizootics there is a slight implication of these organs evinced by the redness of the mucous membrane of the lids, and the escape of tears over the face. But when the ophthalmia becomes an important feature there is excessive swelling of the lids, a profuse purulent discharge from the inner corner of the eye, opacity of the transparent cornea, with or without a painful sensitiveness to light. In bad cases it results in permanent cloudiness of the cornea, or cataract, according to the parts involved.

Further sequelæ.—In overworked or mismanaged horses other affections will sometimes wind up the malady. When the system is greatly depressed, when the vitality of the blood and tissues is greatly impaired by the presence of the fever-poison, when the vital fluid is loaded with the vast products of the rapid tissue changes due to the fever, and to over-exertion on the part of animals utterly unfit for it; when the elimination of these effete matters is almost suspended by the impaired functions of the great excretory organs, such as the lungs, liver, bowels, kidneys, and skin, there is liable to supervene the state known to English veterinarians as *purpura hæmorrhagica*. In this affection there is disorganization and breaking down of the blood particles, and extravasation of the liquid elements of the blood, and in some cases of the coloring elements as well, into the tissues surrounding the blood-vessels. Blood seems to sweat from the swellings in the skin, or from the mucous membrane, and flows from the nose, the intestines, or the urinary passages. The swellings are circumscribed and not situated, like those of dropsy, on the more dependent parts of the body; if they involve the head the whole organ may be engorged until it becomes impossible for the animal to open his mouth or eyelids, or even to breathe. If less extensive, and consisting merely of a circumscribed serous infiltration, the swellings may shift about from day to day, disappearing only from one place to re-appear in another. The blood in such cases is found to contain much free hæmatim, or coloring matter, and fragments of broken-up, red globules; it coagulates imperfectly and loosely, or not at all, but remains as a dark, tarry-looking mass, and before death con-

tains numerous staff-shaped bodies, or *bacteria*, resembling those found in decomposing animal fluids. This affection, which existed to some extent as a sequel of the recent influenza in Boston, New York, and other cities, usually proves fatal in fifty per cent. of animals attacked. I know of but two cases of this complication in Tompkins County, New York, during the recent visitation. One occurred early as the result of heroic treatment; the other after partial convalescence from hard work and exposure.

Glanders and farcy have been among the results of the epizootic of 1872, and, like *purpura hœmorrhagica*, are always liable to break out when the strength is seriously reduced and the blood impoverished and loaded with impurity, in connection with protracted and exhausting disease, impure air, and generally debilitating treatment. Whether these diseases arose *de novo*, or from preserved germs left over from the numerous cases of glanders in New York a few years ago, it will be no easy matter to decide.

The epizootic of 1872, in America, has followed mainly the simple catarrhal type, and has been by no means a fatal affection, the mortality ranging from 1 in 300 in many country districts, to 3 or 5 per cent. in some towns. Yet in a number of instances the various other complications have been noticed, with the exception, perhaps, of the *ophthalmic* ones.

Post-mortem appearances.—These are mainly seen in the respiratory organs. In fatal cases the cavities of the nose, the nasal sinuses, and, still more so, the parts about the throat-fauces, pharynx, and larynx usually have their mucous membrane much tensified, livid, and softened with dark or greenish metallic tints, implying the existence of gangrene. Ulcers or masses of thick tenacious mucus are sometimes present, and the latter have been sometimes mistaken for false membranes. The guttural pouches, and the submaxillary and guttural lymphatic glands are sometimes congested and swollen.

The deep-red hue, and the puffy, softened condition of the mucous membrane are continued throughout the trachea, and, above all, in the bronchia, even to their smallest divisions, and these are more or less completely filled with a frothy mucus.

In cases of unusual virulence and early fatality, or long standing, and with a very impure condition of the blood, the pleuræ (covering of the lungs) and the heart-sac are spotted with petechiæ or blood extravasations, and usually contain effusions of a deep-red bloody aspect, containing little fibrine, and with a very little tendency to coagulation. False membranes in these cavities are far from numerous, and adhesions between the lungs and the sides of the chest rare, except as the result of a pleurisy after the primary disease has subsided. The surface of the lung and the substance of any false membranes have a tendency to a dark-red hue.

When the lungs have been implicated these are commonly found in a state of dropsical infiltration, apoplexy, or gangrene in patches, while hepatization is rare in the early stages, though frequent enough if the disease is prolonged.

The dropsical portion of the lung does not collapse like the healthy part; does not crepitate or crackle on pressure. The pressure of the finger leaves a depression, as in a dropsical limb; it seems solid, sinks in water, and gives exit to much frothy matter when pressed. This is sometimes dependent on disease of the valves of the heart, but in other cases on the altered state of the blood. The pulmonary apoplexy consists in the infiltration of blood into the lung tissue in circumscribed,

rounded, or angular patches, and even sometimes in a diffuse manner. These patches are firm to the touch, black with a slight tinge of red, and rise abruptly to a variable height above the level of the surrounding healthy lung. Like dropsy, it is most frequent toward the lower borders of the lungs, and, like that, arises from disease of the valves of the left side of the heart, or the altered state of the blood, but at times also from a diseased and softened state of the pulmonary blood-vessels, which predisposes them to give way.

Gangrene of the lung is fortunately rare. It is recognized by the bloodless, hardened appearance of the tissue, with bluish, greenish, or other metallic tints, or it may be deliquescent, and with a most repulsive odor. Hepatization is seen mainly about the roots of the lungs or near their lower border. In its early stages the lung is consolidated by a semi-solid infiltration, which drains out when it is cut in thin slices; later it has a firm, dry, granular appearance, like the substance of liver, easily gives way to the pressure of the finger, does not crepitate nor collapse, and sinks in water. It is mainly of a dull deep-red color, varying to a violet. If suppuration has ensued, this changes to a gray color, and drops of pus exude from the freshly-cut surface. The heart is blanched and softened, and sometimes contains clots firm enough and sufficiently adherent to the valves to imply their existence during life. In a recent post-mortem examination of a horse which had suffered from the most agonizing difficulty of breathing for thirty-six hours before death, I found the right ventricle filled with a large clot, very firmly adherent to the tricuspid valve, and composed of superimposed layers, decreasing in firmness from the valves outward. There was some infiltration around the roots of the lungs, but by no means sufficient to account for the dyspnœa. These clots are often divided into a yellow buffed and a deep-red portion, though at other times and in the more malignant cases they are comparatively diffluent, black, and tarry. The valves of the heart are sometimes found thickened, rough and contracted, as the result of inflammation, but chiefly in rheumatic cases.

In the digestive organs the right sac of the stomach and the small intestines are unnaturally vascular, and marked with numerous spots of blood extravasation or staining. The glands are often enlarged, the epithelium is easily detached, and slight punctiform erosions are sometimes met with, but no distinct ulceration. Petechiæ may also be present on the folds of the peritoneum. The intestinal contents are often mingled with excess of mucus, or even colored with blood. The liver is often enlarged, softened, and friable, and of a pale-yellow hue, with brownish spots. In all cases in which the changes in the blood have been extensive, and, above all, in cases which have merged into *purpura hæmorrhagica*, the spleen is engorged with blood and increased in size and weight. The kidneys are usually healthy in aspect, though in some instances enlarged and softened.

The brain is usually found slightly congested, and effusions have been met with in the ventricles, in the arachnoid and sub-arachnoid space. So constant was this lesion during the epizootic of 1836 in London, that Charles Clark concluded, after extensive dissections of dead horses, that this was the primary seat of the disease, and that all other manifestations were simply complications. To these may be added the liquid effusions beneath the skin and between the muscles and tendons in dropsical cases, the inflammations, thickening and redness of tendons and their sheaths, and of joints with the puffy swelling of joints, and other synovial sacs in rheumatic subjects, and the blood-staining of the inner surface of the skin, the gelatinous exudations and the accumula-

tions of blood in the limbs and beneath the skin in various parts characteristic of *purpura hæmorrhagica.*

CAUSES OF THE INFLUENZA.—Unlike the majority of former epidemics whose origin has been obscure, this appears to have sprung into existence in the center of the North American continent, and in a distinct locality, which can be definitely pointed out. It has spread rapidly and steadily in nearly every direction, from this as a center, and, thanks to facilities afforded by railroads and telegraphs, its course has been traceable with ease. The following is intended as a contribution toward securing the lessons which may be learned from the visitation.

The old doctrine of an epidemic constitution of the atmosphere has of late years been gradually waning, as cholera, small-pox, typhoid fever, and other epidemics and epizootics have been traced to more tangible causes, and placed more under human control. More than any other epidemic malady, perhaps, has influenza retained its claim on an atmospheric causation. It has been described as falling simultaneously on all parts of a given district or country, as breaking out in islands a considerable distance from the shore, and without having had any communication with the main-land, and as having attacked the crews of ships in mid-ocean after they had been twenty days at sea. No wonder that we should have had all imaginable general conditions of the earth, water, and air invoked to explain its occurrence; that at one time it has been attributed to the lowness and dampness of a locality; at another to the height, exposure, and coldness; at a third to crowding of population with the resulting impurities of soil, water, and air; in a fourth case to the vicissitudes of weather in late spring, autumn, or winter, or of some unusually variable season; to a persistent low temperature, or sudden variation of temperature; to the prevalence of damps, acrid or fetid fogs, and mists; to excessive rain-fall and unusual humidity of the atmosphere; to an unusually high or low density of the atmosphere; to an excess of ozone in the air; to the telluric emanations attendant on great earthquakes and volcanic eruptions, or to a modified condition of the atmospheric electricity.

The epizootic of 1872 affords but the slenderest appearance of support to any of these hypotheses. Neither soil nor elevation has materially affected it. The prevalence and mortality have been almost the same in the mountains of Vermont and New Hampshire as in the flat, malarious sea-coast of New Jersey, Maryland, and Virginia. The district where it originated, according to the report of Professor A. Smith, is very variable. In the township of York, near Mimicu, Canada West, it is partly "heavy clay and partly a sandy soil, intersected with swamps. In another part of the township of York the soil is formed of clay, intermixed with sand, and the subsoil generally is not porous. In Scarborough and Markham the land is good and the farms well cultivated, the buildings, stables, &c., generally comfortable and well ventilated, and the horses well fed, and otherwise carefully attended to."

The temperature has not exerted any marked influence. The disease has been general wherever it has reached, and the mortality has averaged 1 per cent. or a little over. Indeed, in some cases the comparison has been altogether in favor of the more northern and colder localities. Thus in Fulton County, Georgia, it is reported as universal, and the mortality up to the date of the report had been 1 per cent.; in Dodge County, Wisconsin, on the other hand, although, after the outbreak of the affection, there had been a sudden transition in a single night from a pleasant Indian summer to the rigorous and persistent cold of win-

ter—the thermometer sometimes marking 8° below zero—yet the losses in the country districts are estimated at 1 in 300.

Overcrowding, with its concomitants of hot, damp, vitiated air, has unquestionably been a main cause of the severity and complications of the disease in the large cities, the pneumonias, pleurisies, purpura-hæmorrhagicas, &c., but the malignancy of all specific febrile diseases, occurring with such unwholesome surroundings, forbids that we should attach any importance to these in estimating the causes of this particular disorder. Influenza in man shows a similar malignancy and fatality in unwholesome localities, and in overcrowded portions of cities where hygienic arrangements are imperfect. The observations of Pearson, Parkes, Baker, Gray, and the English registrar-general have sufficiently established this fact. And equine influenza, when more circumscribed than at present, has often confined its ravages to exposed stables, open and swept by draughts of cold air, or close and without ventilation, light or drainage, but with an impure, damp, and stifling atmosphere. Yet such conditions can only retard or prevent the elimination of effete matter from the system, favor the introduction of the deleterious products of decomposition in animal and vegetable matters, saturate the blood with impurities, and by impairing or suspending nutrition and other important functions lay the system open to the access of disease. But while they facilitate the development and increase the severity of all zymotic maladies, they do not determine which specific affection shall be developed in a particular case. That is determined by the prevalence of influenza, glanders, or other specific disorder in the locality at the time. And it is noticeable in this connection that the equine influenza of 1872 did not originate in a crowded city, as is generally supposed.

Sudden changes of weather and temperature.—Nasal and bronchial catarrhs often prevail extensively among horses, as among men, in connection with sudden and extreme variations of temperature, and especially in spring and autumn. These are liable to be confounded with influenza, and hence the idea that this disease is but a simple result of such climatic vicissitudes. In the case of the horse the changeable seasons are often aggravated by the weakness and susceptibility of the system in connection with the spring and autumn changes of coat, the transition from the hot stable to the cool field, or from the clear atmosphere of the pasture to the close, hot, impure air of the stable, the changes from green to dry food, or *vice versa*, and the substitution of work for idleness, or the reverse. That the effect of sudden changes of temperature is very severe on the animal system which has not become habituated to the new condition of life by a gradual transition from one to the other, is well shown in W. Edwards's experiments on cold-blooded animals. Though subjected to a very low temperature in winter the heat of their bodies declined barely four-tenths of a degree, whereas exposure to a cold temperature in summer insured a depression of body-heat to the extent of 3° and even 6° Cent. So it is with warm-blooded animals transferred from a warm to a cold climate. The French cavalry horses, sent from the shores of the Mediterranean to the northern parts of the country, suffer to a great extent from catarrhal and pulmonary affections. But such catarrhal attacks do not spread as an epizootic, nor extend from the newly-arrived horses to those which are permanent residents. Catarrhal symptoms exist, indeed, but the *contagium* which secures an extension and general prevalence of the malady is wanting. Such vicissitudes, therefore, operate like other unwholesome conditions

of life; they predispose the system to the disease, or even increase its severity, but they cannot apparently generate the morbid poison.

The first reported cases of the recent epizootic occurred near Toronto in the last days of September. It is, therefore, of the greatest importance to ascertain what was the state of the weather in that locality during the month of September. Through the kindness of Professor Kingston, of the Magnetic Observatory, Toronto, I am enabled to introduce here tables giving the meteorological register for the month of September, in 1871 and 1872, at Toronto, and a third table giving the records of the same month for the last twenty-eight years at the same place.

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, SEPTEMBER, 1871.

Latitude 43° 39′ 4″ north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Humidity of air.				Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	° ′												°							
1	29.855	29.876	29.877	29.8753	47.5	66.6	55.1	57.72	— 4.83	.293	.363	.396	.353	89	55	91	75	Calm.	S.E. by S.	Calm.	S. 19 E.	0.0	2.2	0.0	1.30	1.35	......	..
2	.942	.885	.842	.8847	52.6	70.6	63.0	63.13	+ 0.88	.334	.399	.413	.391	84	53	71	68	Calm.	S.E. by S.	S. S.W.	S. 19 E.	0.0	11.5	0.8	3.35	3.53	......	..
3	......	.803	......	......	......	73.8	......	......	......	....	.605	....	....	....	72	....	....	S. S.W.	S.	N.E. by E.	S. 40 E.	0.8	6.0	1.8	1.36	2.05	......	..
4	.751	.667	.642	.6823	62.7	75.7	64.1	67.78	+ 6.10	.544	.653	.550	578	95	73	92	86	Calm.	S.E.	Calm.	S. 26 E.	0.0	6.8	0.0	1.87	1.94	......	..
5	.619	.576	.540	.5727	62.3	80.7	65.9	70.58	+ 9.20	.472	.636	.500	.543	84	61	78	73	S. by W.	S.	Calm.	S. 9 W	0.5	12.0	0.0	5.30	5.43	......	..
6	.457	.386	.507	.4608	67.0	76.7	60.5	67.83	+ 6.78	.581	.550	.271	.465	87	60	50	66	S. S.W.	W.	N.W. by W	N. 86 W	4.8	14.0	14.2	8.41	10.43	......	..
7	.697	.757	.836	.7743	47.9	64.5	53.3	55.95	— 4.77	.250	.218	.271	.267	74	35	67	61	W. N.W.	N. by E.	N. by W.	N. 18 W	3.5	5.5	11.8	4.33	5.63	......	..
8	.951	.930	.852	.9132	48.6	63.0	60.5	57.97	— 2.38	.230	.294	.372	.296	67	50	70	61	N. N.E.	E.	E. by S.	S. 70 E.	3.2	11.5	5.6	6.14	7.37	......	..
9	.831	.764	.830	.8037	52.6	73.1	65.2	65.07	+ 5.08	.342	.498	.458	.440	86	62	74	72	Calm.	S.	N. N.W.	S. 59 W	0.0	12.6	8.8	2.45	8.49	.050	..
10	......	.925	......	......	......	64.5	......	......	......	....	.239	....	....	....	39	....	....	N.E. by N.	N. N.E.	N.	N. 2 W	5.6	6.6	7.8	6.28	7.83	......	..
11	30.029	.998	.987	30.0018	50.8	66.6	56.9	58.68	— 0.52	.283	.353	.286	.315	76	54	61	64	N.	S. S.E.	N. by W.	N. 57 E.	6.3	2.6	8.8	1.16	4.43	......	..
12	29.991	.926	.869	29.9195	51.8	67.4	55.1	58.42	— 0.40	.207	.280	.375	.290	53	42	87	61	N. by E.	Calm.	Calm.	S. 62 E.	4.0	0.0	0.0	0.41	0.87	......	..
13	.815	.803	.923	.8583	46.4	69.2	52.9	55,50	— 2.92	.269	.234	.174	.212	85	32	43	51	Calm.	N.W. by W	N.	N. 25 W	0.0	15.5	3.4	6.81	6.89	......	..
14	30.069	30.034	.941	.9945	39.2	51.1	51.5	48.42	— 9.60	.139	.208	.264	.220	57	55	69	62	N. by E.	E.	E. by S.	N. 82 E.	3.8	6.8	9.0	5.31	5.93	inap.	..
15	29.788	29.676	.567	.6703	54.0	52.6	52.9	52.75	— 4.87	.335	.353	.371	.344	80	89	92	86	E. by S.	E. by S.	N.W.	S. 76 E.	7.6	9.5	1.2	4.34	7.28	.425	..
16	.565	.562	.548	.5563	52.2	60.9	57.6	57.02	— 0.20	.348	.379	.353	.373	89	71	74	80	N.W. by W	S. by W.	Calm.	N. 70 W	1.9	5.2	0.0	2.42	2.84	.100	..
17	......	.794	......	......	......	52.9	......	......	......	...	.221	....	....	....	56	....	....	W.	N.W. by N.	Calm.	N. 44 W	8.3	26.0	0.0	10.16	10.42	......	..
18	.944	.793	.508	.7220	37.4	53.3	53.6	49.55	— 6.82	.170	.250	.340	.267	76	62	83	74	N. N.E.	E. S.E.	Calm.	S. 54 E.	3.0	3.2	0.0	3.53	4.90	.005	..
19	.401	.474	.619	.5117	55.4	57.6	47.5	53.87	— 2.07	.418	.330	.216	.316	94	69	65	74	Calm.	N.W.	N. by W.	N. 49 W	0.0	17.0	10.2	7.71	8.21	......	..
20	.727	.780	.888	.8070	36.3	49.0	40.3	42.70	—12.85	.160	.169	.184	.174	75	48	73	65	Calm.	N.W.	N.W. by N	N. 30 W	0.0	9.0	5.8	5.44	5.76	......	..
21	.989	30.006	.954	.9752	34.5	50.0	37.8	41.85	—13.27	.136	.212	.191	.179	67	58	82	67	N. by W.	S. by W.	Calm.	N. 33 E.	3.2	3.6	0.0	0.81	2.00	......	..
22	.915	29.762	.596	.7410	37.4	59.4	47.5	50.87	— 3.82	.188	.307	.293	.276	83	60	89	74	N. by E.	S.E. by S.	Calm.	S. 9 E.	6.0	6.6	0.0	3.15	3.73	......	..
23	.455	.353	.365	.3847	58.7	68.8	64.5	64.30	+10.03	.408	.462	.467	.450	82	65	76	74	S.W. by S.	S. by W.	W. by S.	S. 42 W	7.0	10.2	11.0	6.77	7.19	......	..
24	......	.420	......	......	......	67.7	......	......	......	....	.175	....	....	....	25	....	....	S.W. by W	W. by N.	Calm.	N. 76 W	2.7	24.0	0.0	7.54	7.59	......	..
25	.595	.521	.489	.5205	42.8	62.3	53.6	53.80	+ 0.38	.240	.236	.351	.287	87	41	85	72	Calm.	W. by S.	W. N.W.	S. 82 W	0.0	7.2	4.0	2.13	3.00	.650	..
26	.353	.338	.357	.3468	47.9	51.8	43.9	47.93	— 5.05	.312	.249	.235	.263	93	64	82	79	Calm.	W. by S.	W. S.W.	S. 77 W	0.0	15.0	4.2	5.91	5.96	.030	..
27	.335	.309	.367	.3323	42.5	50.8	45.7	46.87	— 5.73	.244	.330	.268	.273	89	89	88	84	S.W.	S. by W.	Calm.	S. 66 W	3.5	5.8	0.0	5.34	5.68	.030	..
28	.426	.530	.710	.5715	39.6	49.7	42.8	44.28	— 7.90	.220	.236	.213	.226	90	65	77	77	Calm.	N.W. by W	W. N.W.	N. 60 W	0.0	16.0	12.4	10.24	10.35	......	..
29	.825	.901	.952	.9608	38.1	52.6	41.0	44.02	— 7.73	,179	.192	.210	.196	77	48	82	69	W. N.W.	N.W.	W. by N.	N. 55 W	4.5	15.0	0.8	5.90	6.05	......	..
30	.974	.942	.912	.9390	38.8	58.7	46.8	48.40	— 2.98	.203	.305	.225	.244	86	62	70	73	W.	S.E. by S.	Calm.	S. 66 W	2.2	2.8	0.0	1.28	1.99	......	..
	29.7423	29.7131	29.7107	29.7200	47.88	61.64	53.06	54.82	— 2.43	.289	.334	.317	.317	81	59	76	71	....	....	....	....	2.75	9.66	4.05	.....	5.50	1.290	..

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Latitude 43° 39′ 4″ north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Relative humidity.				Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	°												°							
1	......	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	N. W.	N. W.	Calm.	N. 57 W	10.0	19.0	0.0	10.64	10.77	.....	..
2	29.602	29.640	29.731	29.6703	65.0	70.1	54.2	62.08	— 0.17	.439	.322	.208	.305	71	44	49	53	N. W.	N. W.	N.	N. 31 W	10.4	15.2	12.6	12.13	13.00	.....	..
3	.821	.752	.719	.7622	44.8	60.0	50.3	52.05	— 9.93	.214	.281	.230	.220	72	53	63	59	N.	S. W.	N.	N. 12 W	1.0	3.4	4.2	2.07	3.77	.....	..
4	.750	.644	.592	.6515	45.9	60.7	55.0	55.07	— 6.62	.249	.349	.402	.330	80	66	93	76	Calm.	S.	Calm.	S. 1 E.	0.0	5.1	0.0	1.72	1.98	.150	..
5	.450	.416	.412	.4273	54.6	66.5	62.9	61.60	+ 0.22	.407	.566	.547	.506	95	87	95	92	N. E.	E.	E.	S. 72 E.	2.5	1.0	1.5	1.34	1.62	.050	..
6	.416	.452	.457	.4463	62.5	73.7	65.1	66.73	+ 5.68	.566	.675	.585	.598	100	81	94	91	Calm.	S.	Calm.	S. 67 E.	0.0	1.2	0.0	1.57	1.75	.190	..
7	.510	.477	.513	.4985	61.4	82.0	73.0	72.85	+12.13	.513	.727	.684	.651	94	67	84	81	Calm.	S. W.	Calm.	S. 37 W.	0.0	12.7	0.0	3.29	3.35	.....	..
8	......	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	Calm.	W.	N.	N. 87 W	0.0	14.5	8.8	2.90	3.90	.010	..
9	.713	.738	.751	.7352	64.0	63.6	61.8	63.48	+ 3.50	.507	.512	.469	.500	85	87	85	85	N. E.	E.	E.	N. 77 E.	4.4	8.6	8.2	6.14	6.39	.200	..
10	.750	.713	.751	.7322	61.4	72.6	63.2	65.27	+ 5.67	.512	.601	.451	.519	94	75	78	83	N. E.	Calm.	N.	N. 77 E.	2.4	0.0	1.0	2.76	3.01	Inap	..
11	.768	.699	.614	.6822	63.2	71.9	66.5	67.62	+ 8.42	.569	.654	.593	.609	98	84	91	90	Calm.	E.	S. E.	S. 82 E.	0.0	6.0	1.4	1.92	2.02	.....	..
12	.505	.301	.391	.4110	66.5	72.6	63.6	67.50	+ 8.68	.580	.631	.537	.596	89	78	92	88	E.	S.	N. W.	S. 30 E.	3.2	10.2	2.5	0.84	3.21	.460	..
13	.423	.667	.848	.6645	62.5	61.4	52.4	58.17	— 0.25	.526	.412	.327	.393	93	76	83	80	W.	N. W.	N. W.	N. 46 W	13.2	22.4	4.2	12.47	12.68	.050	..
14	.916	.918	.924	.9117	45.6	63.6	53.1	54.88	— 3.13	.260	.243	.317	.273	85	41	78	66	Calm.	N.	N.	N. 2 E.	0.0	5.5	8.6	5.14	5.25	.....	..
15	......	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	N.	S.	Calm.	N. 88 E.	3.4	5.3	0.0	1.21	2.76	.....	..
16	.718	.584	.548	.6045	45.6	61.8	56.8	56.10	— 1.12	.241	.384	.378	.346	79	70	81	76	N.	S.	N. E.	S. 59 E.	1.2	1.0	3.0	0.51	1.69	.....	..
17	.554	.537	.562	.5495	53.5	64.7	50.3	56.22	— 0.57	.355	.418	.321	.366	86	68	88	81	N.	S. W.	Calm.	N. 68 W	2.0	5.6	0.0	0.39	1.71	.....	..
18	.500	.360	.276	.3702	43.0	59.3	54.2	53.85	— 2.52	.256	.405	.389	.364	92	80	92	87	Calm.	S.	S. W.	S. 27 W	0.0	12.8	4.2	3.05	3.57	.500	..
19	.234	.287	.510	.3568	49.9	60.4	52.4	53.58	— 2.35	.336	.353	.358	.347	93	67	91	85	N. W.	N. W.	N. W.	N. 61 W	0.2	16.0	11.4	7.60	8.09	.508	..
20	.657	.707	.721	.7020	49.8	61.1	52.1	54.42	— 1.13	.294	.276	.297	.291	82	51	76	70	N. W.	N. W.	Calm.	N. 54 W	1.0	8.3	0.0	7.12	7.51	.....	..
21	.646	.524	.486	.5450	48.4	64.3	57.5	57.12	+ 2.00	.294	.387	.418	.381	86	64	88	82	Calm.	E.	N. E.	S. 87 E.	0.0	4.8	0.2	1.19	1.27	.....	..
22	......	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	W.	S. W.	Calm.	S. 55 W.	0.8	4.6	0.0	1.73	1.96	.050	..
23	.741	.686	.708	.7005	59.3	66.9	60.7	62.30	+ 8.03	.503	.518	.497	.505	99	79	93	90	N. E.	E.	Calm.	N. 79 E.	3.5	5.7	0.0	2.68	2.98	.030	..
24	.733	.693	.561	.6550	60.4	72.3	66.1	67.33	+13.50	.488	.531	.504	.511	93	67	79	77	Calm.	E.	S. E.	S. 58 E.	0.0	3.0	4.4	1.65	1.82	.....	..
25	.428	.466	.587	.4985	67.6	65.0	53.1	61.62	+ 8.20	.484	.414	.349	.430	72	67	86	78	S.	S. W.	W.	S. 25 W.	12.5	8.4	2.2	7.30	9.13	.028	..
26	.578	.470	.343	.4613	42.7	63.6	59.3	56.15	+ 3.17	.234	.337	.394	.325	85	57	78	72	Calm.	S.	N. W.	S. 26 W.	0.0	13.6	17.0	6.75	7.16	.080	..
27	.511	.575	.652	.5912	44.5	56.8	46.3	48.82	— 3.78	.237	.235	.251	.235	80	50	79	69	W.	W.	Calm.	N. 82 W	5.6	13.8	0.0	5.25	5.69	Inap	..
28	.754	.718	.590	.6860	39.1	56.4	53.5	50.68	— 1.50	.206	.260	.288	.256	86	57	70	70	N. W.	S. E.	E.	S. 61 E.	0.6	5.6	12.0	2.25	4.15	.....	..
29	......	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	E.	S. W.	S. W.	S. 8 W.	9.8	13.8	13.5	7.93	13.98	.220	..
30	.432	.512	.602	.5292	49.9	57.1	49.5	52.23	+ 0.85	.274	.286	.301	.282	76	62	84	72	S. W.	W.	Calm.	S. 77 W.	2.2	10.3	0.0	8.85	9.18	.....	..
	29.6044	29.5838	29.5940	29.5937	54.05	65.13	57.32	59.11	+ 1.86	.382	.431	.404	.406	87	67	83	78	....	....	....	....	3.00	8.58	4.03	.....	5.24	2.526	..

Comparative table for September.

Year.	Temperature. Mean.	Temperature. Excess above average.	Temperature. Maximum.	Temperature. Minimum.	Temperature. Range.	Rain. Number of days.	Rain. Inches.	Snow. Number of days.	Snow. Inches.	Wind. Resultant. Direction.	Wind. Resultant. Velocity.	Wind. Mean velocity.
	°	°	°	°	°					°		
1844	58.6	+ 0.6	81.8	28.2	53.6	4	Impr.	......	......	......	......	0.26 lbs.
1845	56.0	− 2.0	79.6	34.0	45.6	16	6.245	......	......	......	......	0.34
1846	63.6	+ 5.6	84.3	37.3	47.0	11	4.595	......	......	......	......	0.33
1847	55.6	− 2.4	74.5	35.0	39.5	15	6.665	......	......	......	......	0.33
1848	54.2	− 3.8	80.4	28.1	52.3	11	3.115	......	......	N 71 W	2.38	5.81 mls.
1849	58.2	+ 0.2	80.1	32.7	47.4	9	1.480	......	......	N 75 W	0.69	4.23
1850	56.5	− 1.5	76.0	29.5	46.5	11	1.735	......	......	S 65 W	1.02	4.78
1851	60.0	+ 2.0	86.3	32.0	54.3	9	2.665	......	......	N 14 E	1.03	5.45
1852	57.5	− 0.5	81.8	35.8	46.0	10	3.630	......	......	N 17 W	0.53	4.60
1853	58.8	+ 0.8	85.5	33.9	51.6	12	5.140	......	......	N	1.06	4.33
1854	61.0	+ 3.0	93.6	35.8	57.8	14	5.375	......	......	N 22 W	1.33	4.04
1855	59.5	+ 1.5	82.6	33.0	49.6	12	5.585	......	......	N 20 E	1.29	7.61
1856	57.1	− 0.9	78.4	35.0	43.4	13	4.105	......	......	S 79 W	1.98	6.53
1857	58.6	+ 0.6	82.0	34.1	47.9	11	2.640	......	......	N 68 W	1.61	6.55
1858	59.1	+ 1.1	81.4	35.6	45.8	8	0.735	......	......	S 74 W	1.53	5.69
1859	55.2	− 2.8	75.4	35.7	39.7	15	3.525	......	......	N 44 W	1.60	6.36
1860	55.3	− 2.7	75.8	28.7	47.1	14	1.959	......	......	N 71 W	2.63	5.79
1861	59.1	+ 1.1	78.8	37.1	41.7	17	3.607	......	......	N 71 W	1.39	4.81
1862	59.6	+ 1.6	79.4	39.0	40.4	9	2.344	......	......	N 59 W	1.07	5.11
1863	55.9	− 2.1	80.0	31.4	48.6	8	1.235	......	......	N 16 W	1.92	6.46
1864	56.4	− 1.6	73.0	37.8	35.2	11	2.508	......	......	N 38 W	1.89	7.06
1865	64.5	+ 6.5	90.5	42.0	48.5	12	2.450	......	......	S 56 E	0.47	4.12
1866	55.2	− 2.8	80.0	34.4	45.6	15	5.657	......	......	N 33 W	1.45	4.63
1867	57.9	− 0.1	87.0	31.8	55.2	9	1.226	......	......	N 37 W	1.48	5.43
1868	56.6	− 1.4	75.5	36.0	39.5	16	4.239	......	......	N 74 W	0.88	6.68
1869	60.7	+ 2.7	81.0	34.4	46.6	8	4.027	......	......	N 53 W	1.16	4.89
1870	61.8	+ 3.8	78.0	45.8	32.2	11	6.794	......	......	N 29 E	2.26	5.04
1871	54.8	− 3.2	81.8	34.0	47.8	8	1.290	......	......	N 74 W	1.72	5.50
1872	59.1	+ 1.1	84.4	38.2	46.2	16	2.526	......	......	N 79 W	1.47	5.24
Results to 1871	58.04	....	80.88	34.58	46.30	11.06	3.716	......	......	N 52 W	1.06	5.44
Excess for 1872	+1.07	....	+3.52	+3.62	−0.10	+4.94	−1.190	......	......	....	......	−0.20

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1871.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those which relate to the wind, are derived from six observations daily, namely at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and resultants of the wind are from hourly observations.

Highest barometer ....30.090 at 10 a. m. on 14th } Monthly range=0.790.
Lowest barometer ....29.300 at 2 p. m. on 27th }

[illegible] Self-register-ing ther. { Maximum temperature ....81°8 on 5th } Monthly range=47°8.
Minimum temperature ....34.0 on 21st }
Mean maximum temperature ....64°53 } Mean daily range=17°63.
Mean minimum temperature ....46°90 }
Greatest daily range ....31°5 from p. m. of 13th to a. m. of 14th.
Least daily range ....6°4 from a. m. to p. m. of 15th.

Warmest day, 5th ....mean temperature 70°58 } Difference=28°73.
Coldest day, 21st ....mean temperature 41°85 }

Maximum radiation { Solar ....92°4 on 6th } Monthly range=67°4.
Terrestrial ....25°0 on 21st }

Aurora observed on 4 nights, viz, 4th, 6th, 7th, and 19th.
Possible to see aurora on 20 nights; impossible on 10 nights.
Raining on 8 days; depth, 1.290 inches; duration of fall, 27.7 hours.

WIND.

Resultant direction, N. 74° W.; resultant velocity, 1.72.
Mean velocity, 5.50 miles per hour.
Maximum velocity, 26.0 miles, from 1.30 p. m to 2.30 p. m of 17th.
Most windy day, 6th; mean velocity, 10.43 miles per hour.
Least windy day, 12th; mean velocity, 0.87 mile per hour.
Most windy hour, 1 p. m.; mean velocity, 9.55 miles per hour.
Least windy hour, 4 a. m.; mean velocity, 2.34 miles per hour.
Fog on 1st, 4th, 5th, 13th, 16th, and 19th.
Dew on 12 occasions.
First frost of season on 18th.
Ice on 21st and 22d.
Thunder on 3d and 18th.
Lightning on 18th.

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1872.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and resultants of the wind are from hourly observations.

Highest barometer		29.942 at 8 a. m. on 14th	Monthly range, 0.728.
Lowest barometer		29.214 at 7 a. m. on 29th	
Self-registering ther.	Maximum temperature	84°4 on 7th	Monthly range, 46°2.
	Minimum temperature	38.2 on 28th	
	Mean maximum temperature	68°68	Mean daily range, 18°17.
	Mean minimum temperature	50°51	
	Greatest daily range	27°5 from a. m. to p. m. of 1st.	
	Least daily range	9°0 from a. m. to p. m. of 9th.	
Warmest day		7th; mean temperature 72°85	Difference=24°03.
Coldest day		27th; mean temperature 48°82	
Maximum radiation	Solar	149°0 on 1st	Monthly range=121°6.
	Terrestrial	27°4 on 3d	

Aurora observed on 4 nights, viz, 2d, 3d, 9th, and 29th.
Possible to see aurora on 18 nights; impossible on 12 nights.
Raining on 16 days; depth, 2.526 inches; duration of fall, 43.4 hours.
Mean of cloudiness, 0.58.

WIND.

Resultant direction, N. 79° W.; resultant velocity, 1.47 miles.
Mean velocity, 5.24 miles per hour.
Maximum velocity, 29.0 miles, from 9 to 10 a. m. of 13th.
Most windy day, 29th; mean velocity, 13.98 miles per hour.
Least windy day, 21st; mean velocity, 1.27 miles per hour.
Most windy hour, 1 p. m.; mean velocity, 9.16 miles per hour.
Least windy hour, 5 a. m.; mean velocity, 2.93 miles per hour.
Fog on 6th, 11th, and 18th.
Dew on 6th, 15th, 21st, and 24th.
Frost on 3d, 14th, 16th, 26th, 27th, and 28th. Ice on 27th.
Thunder or lightning on 5th, 6th, 7th, 8th, 12th, 18th, 19th, 22d, 23d, 26th, and 29th.
Hail of large size and to a considerable amount fell in the storm of the 19th.
Solar rainbow on 12th. Lunar rainbow on 19th at 8 p. m.

From these tables it is manifest that there was no extraordinary state nor extreme changes in the weather during the whole of the month, the last days of which witnessed the outbreak. The mean temperature was in excess of that of September, 1871, but considerably below that of this month in many previous years. Both maximum and minimum temperature are slightly above those of 1871, but the maximum is less, and the minimum more than those of several previous non-influenza years. The monthly range of temperature was nearly 2° less than [illegible] of 1871, and 11° under that of 1854, which was not an influenza y[illegible] It may be added that the greatest daily range for September, 1872, [illegible] 27°5, while for September, 1871, it was 31°5. The greatest veloc[illegible] of the wind in September, 1872, was 2.24 miles on the 13th, wind in the northwest, and temperature 61°4. The highest velocity in September, 1871, was 26°0 miles on the 17th, with wind northwest by north, and temperature 52°9. Appended are the tables for October, 1871 and 1872, which show that month to have been no more remarkable through the period of the greatest prevalence of the influenza.

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, OCTOBER, 1871.

Latitude 43° 39′ 4″ *north.* *Longitude* 5*h.* 17*m.* 33*s.* *west.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barometer at temp. of 32°.				Temperature of the air				Excess of mean above normal.	Tension of vapor.				Humidity of air.				Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	°												°							
1	......	29. 789	......	......	......	65. 2	......	......	......	....	. 297	....	....	....	48	....	....	Calm.	S. S. W.	W. S. W.	S. 31 W.	0. 0	10. 3	3. 3	3. 46	3. 65	Inap	..
2	29. 711	. 550	29. 444	29. 5497	47. 1	65. 9	56. 2	56. 28	+ 5. 70	. 291	. 399	. 360	. 343	90	62	80	76	Calm.	S. by E.	S. by E.	S. 10 W.	0. 0	16. 0	4. 5	4. 79	5. 21	. 100	..
3	. 308	. 310	. 196	. 2598	54. 4	58. 0	53. 6	55. 83	+ 5. 60	. 385	. 336	. 319	. 343	90	70	78	77	S. W. by S.	W. by S.	S. W. by S.	S. 71 W.	5. 5	16. 5	9. 5	8. 43	9. 22	Inap	..
4	. 345	. 444	. 536	. 4523	48. 2	62. 8	46. 1	53. 25	+ 3. 40	. 264	. 229	. 244	. 244	78	39	78	63	W.	W. by S.	N. N. E.	S. 88 W.	8. 6	18. 2	1. 0	5. 69	8. 68	.....	..
5	. 427	. 348	. 385	. 3795	48. 2	66. 3	56. 2	56. 72	+ 7. 20	. 286	. 324	. 360	. 324	86	50	80	72	E. by N.	S. S. W.	N. by E.	S. 26 W.	3. 0	13. 0	3. 0	4. 14	5. 54	Inap	..
6	. 332	. 468	. 659	. 5057	54. 0	55. 5	44. 3	50. 65	+ 1. 52	. 335	. 201	. 212	. 244	80	45	72	65	W. by S.	W. N. W.	W. N. W.	N. 61 W.	0. 6	19. 8	6. 2	10. 79	11. 05	.....	..
7	. 753	. 762	. 793	. 7735	31. 3	45. 4	36. 7	39. 00	— 9. 78	. 151	. 188	. 163	. 165	86	61	75	71	Calm.	S. by W.	W. by S.	S. 20 W.	0. 0	5. 6	1. 0	1. 64	2. 42	.....	..
8	......	. 774	......	......	......	58. 7	......	......	......	....	. 273	....	....	....	55	....	....	W. S. W.	S. by W.	S. W.	S. 25 W.	0. 8	15. 0	5. 0	5. 19	5. 44	.....	..
9	. 746	. 613	. 557	. 6327	45. 0	66. 3	54. 7	56. 18	+ 8. 05	. 258	. 419	. 347	. 345	86	65	81	76	Calm.	S. S. W.	S.	S. 18 W.	0. 0	15. 0	0. 5	7. 76	7. 82	.....	..
10	. 495	. 347	. 475	. 4388	52. 9	63. 4	51. 8	55. 88	+ 8. 07	. 306	. 369	. 237	. 302	76	63	61	66	S.	S. S. W.	W.	S. 37 W.	4. 5	8. 2	20. 0	8. 00	9. 26	. 115	..
11	. 620	. 683	. 707	. 6738	42. 1	50. 8	46. 8	46. 55	— 0. 97	. 222	. 238	. 249	. 244	83	63	79	77	S. W. by W.	W. by N.	E. by N.	S. 80 W.	2. 0	5. 9	1. 0	2. 47	2. 87	Inap	..
12	. 728	. 787	. 912	. 8175	38. 9	53. 3	43. 5	45. 18	— 2. 00	. 168	. 260	. 186	. 202	70	63	66	66	N. N. W.	S. W. by S.	W. by N.	S. 83 W.	3. 8	9. 0	4. 0	1. 91	3. 15	.....	..
13	30. 018	. 956	. 826	. 9282	36. 0	58. 0	50. 0	48. 72	+ 1. 82	. 197	. 229	. 251	. 238	93	47	69	71	W. N. W.	S. by E.	S. by E.	S. 19 E.	1. 8	8. 8	7. 2	4. 97	5. 66	.....	..
14	29. 741	. 709	. 587	. 6775	51. 8	56. 2	54. 4	54. 07	+ 7. 47	. 311	. 382	. 395	. 360	81	84	93	86	S. S. W.	S. S. W.	E. S. E.	S. 15 W.	4. 6	10. 4	4. 0	8. 29	8. 97	. 035	..
15	......	. 535	......	......	......	53. 6	......	....	......	....	. 216	....	....	....	52	....	....	S. W. by S.	W.	W. S. W.	S. 77 W.	23. 2	28. 4	2. 7	14. 66	15. 26	.....	..
16	. 747	. 615	. 686	. 6848	40. 7	55. 8	42. 5	45. 77	— 0. 30	. 214	. 184	. 199	. 202	83	41	73	67	W. S. W.	W. S. W.	W. by N.	S. 69 W.	1. 8	13. 8	3. 4	6. 56	7. 62	.....	..
17	. 735	. 670	. 623	. 6772	34. 9	47. 9	43. 9	42. 40	— 3. 38	. 169	. 202	. 235	. 208	84	60	82	77	W. N. W.	S. by W.	W.	S. 73 W.	1. 8	6. 8	9. 0	5. 62	7. 76	Inap	..
18	. 731	. 834	. 816	. 6013	39. 2	43. 2	34. 5	39. 03	— 6. 50	. 198	. 129	. 144	. 157	83	45	72	66	N. W. by W	N. W.	Calm.	N. 62 W.	14. 2	22. 0	0. 0	7. 40	9. 25	. 060	..
19	. 621	. 235	. 546	. 4670	40. 7	56. 9	45. 0	48. 85	+ 3. 58	. 214	. 253	. 175	. 207	84	54	58	61	S. by E.	S. W. by S.	W.	N. 88 W.	7. 6	15. 0	11. 5	13. 47	17. 41	.....	..
20	. 875	. 995	30. 036	. 9747	36. 3	43. 2	33. 1	38. 62	— 6. 43	. 168	. 146	. 131	. 157	78	51	70	67	N.	N. W.	N. N. E.	N. 27 W.	9. 6	13. 0	4. 6	4. 26	8. 55	.....	..
21	. 904	. 682	29. 626	. 7297	34. 5	56. 0	51. 5	47. 92	+ 3. 12	. 174	. 255	. 274	. 237	88	57	71	71	S. S. E.	S. by W.	S. W.	S. 35 W.	3. 3	8. 2	5. 5	5. 60	6. 31	.....	..
22	......	. 507	......	......	......	71. 0	......	....	......	....	. 244	....	....	....	32	....	....	S. S. W.	S. W. by W	S. W.	S. 45 W.	5. 8	23. 5	11. 6	9. 47	9. 64	.....	..
23	. 499	. 504	. 708	. 5788	55. 8	62. 3	50. 8	55. 98	+ 11. 67	. 332	. 420	. 233	. 331	75	75	63	71	W. by S.	S. S. W.	N.	N. 48 W.	10. 8	5. 0	10. 0	4. 64	7. 81	.....	..
24	. 802	. 852	. 924	. 8697	41. 4	46. 4	43. 2	43. 10	— 0. 95	. 204	. 203	. 198	. 196	78	64	70	70	N. N. E.	E.	N. E. by E.	N. 62 E.	6. 0	7. 4	11. 5	6. 11	6. 72	.....	..
25	. 873	. 772	. 715	. 7807	39. 6	50. 0	51. 1	47. 27	+ 3. 47	. 150	. 294	. 341	. 264	62	81	90	78	N. E. by E.	E. N. E.	E. by S.	N. 72 E.	9. 8	13. 2	7. 5	10. 30	10. 52	. 050	..
26	. 638	. 435	. 496	. 5202	50. 4	60. 9	51. 5	53. 53	+ 9. 95	. 320	. 390	. 347	. 354	86	74	91	86	E. by S.	E. by S.	W. by S.	S. 3 E.	7. 4	8. 0	9. 6	3. 75	7. 89	. 510	..
27	. 459	. 254	. 303	. 3367	43. 5	53. 3	40. 3	44. 87	+ 1. 52	. 241	. 271	. 201	. 233	85	66	80	78	S. W. by S.	S. W.	W. by N.	S. 68 W.	4. 2	13. 0	2. 7	7. 72	9. 32	. 065	..
28	. 415	. 521	. 651	. 5462	36. 3	42. 5	40. 3	39. 58	— 3. 52	. 160	. 155	. 184	. 165	75	57	73	68	W. by S.	W. by S.	W. by S.	S. 84 W.	13. 5	23. 8	14. 6	11. 69	12. 43	.....	..
29	......	. 875	......	......	......	45. 0	......	....	......	....	. 184	....	....	....	61	....	....	N. W.	N. by W.	N. N. E.	N. 23 W.	4. 0	10. 0	4. 3	1. 87	5. 15	.....	..
30	. 859	. 672	. 806	. 7793	41. 7	49. 3	45. 3	45. 45	+ 2. 82	. 192	. 232	. 217	. 211	72	65	71	69	S. E.	E. by N.	N. W. by W.	N. 78 E.	10. 4	4. 0	5. 8	1. 44	4. 91	.....	..
31	. 878	. 711	. 389	. 6217	40. 7	46. 8	46. 1	44. 70	+ 2. 28	. 187	. 216	. 282	. 235	73	67	91	79	N. W. by N.	E. by N.	E.	N. 66 E.	2 8	8. 6	16. 6	4. 83	7. 64	. 250	..
	29. 6638	29. 6050	29. 6308	29. 6329	43. 29	54. 48	46. 67	48. 28	+ 1. 99	. 234	. 266	. 249	. 250	81	60	76	72	....	....	....	....	5. 53	12. 75	6. 49	.....	7. 84	1. 185	..

MONTHLY METEOROLOGICAL REGISTER AT THE MAGNETICAL OBSERVATORY, TORONTO, ONTARIO, OCTOBER, 1872.

Latitude 43° 39′ 4″ north. Longitude 5h. 17m. 33s. west. Elevation above Lake Ontario, 108 feet.

Day.	Barometer at temp. of 32°.				Temperature of the air.				Excess of mean above normal.	Tension of vapor.				Humidity of air.				Direction of wind.			Resultant.	Velocity of wind.					Rain, in inches.	Snow, in inches.
	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.		6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.	Mean.	6 a. m.	2 p. m.	10 p. m.		6 a. m.	2 p. m.	10 p. m.	Resultant.	Mean.		
					°	°	°	°	°												°							
1	29. 620	29. 607	29. 650	29. 6253	45. 9	52. 8	42. 7	47. 13	— 3. 85	. 259	. 267	. 234	. 248	84	66	85	77	Calm.	N.	Calm.	N. 40 W.	0. 0	17. 2	0. 0	4. 76	4. 94	Inap	.....
2	. 643	. 528	. 494	. 5487	40. 2	58. 2	48. 1	48. 83	— 1. 75	. 229	. 226	. 230	. 227	92	46	68	68	Calm.	N. W.	Calm.	N. 68 W.	0. 0	9. 4	0. 0	3. 52	3. 69	.....	.....
3	. 401	. 321	. 493	. 4083	44. 5	60. 7	48. 4	51. 08	+ 0 85	. 255	. 349	. 246	. 279	87	65	71	74	Calm.	N. W.	N.	N. 57 W.	0. 0	22. 2	1. 2	4. 49	5. 16	Inap	.....
4	. 631	. 675	. 688	. 6628	41. 6	55. 7	47. 0	49. 35	— 0. 50	. 240	. 250	. 242	. 255	91	56	75	74	Calm.	S. E.	Calm.	S. 67 E.	0. 0	3. 4	0. 0	0. 40	1. 25	.....	.....
5	. 587	. 536	. 557	. 5560	50. 3	61. 8	55. 3	56. 63	+ 7. 12	. 331	. 407	. 397	. 383	91	74	91	84	E.	E.	Calm.	S. 89 E.	4. 4	3. 0	0. 0	3. 79	3. 85	.....	.....
6	......	......	......	......	......	......	......	......	......	.....	.....	.....	.....	.....		.....	.....	N.	Calm.	N.	N. 6 W.	4. 6	0. 0	1. 4	2. 66	2. 97	. 880	.....
7	. 595	. 602	. 684	. 6300	51. 3	57. 8	48. 1	51. 55	+ 2. 77	. 352	. 331	. 259	. 310	93	69	73	81	N. W.	N.	N. W.	N. 25 W.	2. 8	4. 9	8. 0	5. 17	5. 27	. 100	.....
8	. 760	. 746	. 732	. 7487	40. 2	55. 0	43. 8	46. 43	— 2. 02	. 220	. 269	. 200	. 234	88	62	70	75	N. W.	S.	Calm.	N. 75 W.	1. 0	5. 0	0. 0	0. 73	1. 75	.....	.....
9	. 694	. 525	. 466	. 5452	43. 0	63. 6	55. 7	54. 95	+ 6. 82	. 248	. 408	. 359	. 345	89	69	80	79	Calm.	S. W.	S. W.	S. 35 W.	0. 0	13. 9	6. 8	4. 13	4. 46	.....	.....
10	. 485	. 554	. 668	. 5850	48. 8	48. 8	38. 4	43. 72	— 4. 10	. 320	. 172	. 173	. 213	93	50	73	74	N. W.	W.	N. W.	N. 57 W.	10. 5	19. 1	8. 8	10. 06	10. 45	. 010	.....
11	. 779	. 822	. 806	. 8078	48. 0	42. 7	36. 9	38. 88	— 8. 63	. 186	. 168	. 184	. 173	81	61	84	73	N W	W.	Calm.	N. 46 W.	3. 0	7. 4	0. 0	3. 96	4. 27	.....	.....
12	. 708	. 546	. 459	. 5528	32. 2	49. 2	44. 1	42. 80	— 4. 38	. 162	. 225	. 224	. 210	89	64	77	76	Calm.	S.	Calm.	S. 26 W.	0. 0	5. 4	0. 0	2. 54	2. 66	. 060	.....
13	......	......	......	......	......	......	......	......	......	.....	.....	.....	.....	.....		.....	.....	Calm.	S.	N. W.	N. 39 W.	0. 0	0. 8	6. 2	1. 19	1. 53	. 240	.....
14	. 238	. 290	. 456	. 3375	39. 8	44. 5	36. 2	39. 87	— 6. 73	. 188	. 173	. 159	. 170	77	58	74	69	N.	N. W.	W.	N. 33 W.	12. 6	26. 8	1. 0	14. 81	15. 19	.....	.....
15	. 473	. 354	. 252	. 3423	31. 9	38. 7	42. 0	39. 03	— 7. 32	. 164	. 202	. 251	. 205	91	86	94	86	Calm.	S.	Calm.	S 34 W.	0. 0	4. 4	0. 0	2. 21	2. 62	. 010	Inap
16	. 298	. 716	. 897	. 6763	43. 0	47. 0	32. 6	41. 12	— 4. 95	. 256	. 158	. 164	. 183	92	49	89	72	N. W.	N. W.	Calm.	N. 35 W.	16. 0	18. 6	0. 0	9. 26	9. 67	.....	.....
17	. 869	. 637	. 612	. 6945	33. 3	41. 8	43. 4	41. 08	— 4. 70	. 163	. 253	. 260	. 228	86	96	93	88	E.	N. E.	W.	N. 87 E.	5. 0	0. 4	3. 4	1. 21	2. 52	. 308	.....
18	. 674	. 695	. 737	. 7057	36. 9	52. 8	41. 2	43. 20	— 2. 33	. 208	. 216	. 224	. 227	95	54	87	83	Calm.	N. W.	Calm.	N. 55 W.	0. 0	6. 6	0. 0	1. 75	1. 84	. 020	.....
19	. 723	. 777	. 834	. 7885	34. 4	43. 4	33. 0	37. 72	— 7. 55	. 174	. 125	. 160	. 162	88	43	85	73	Calm.	N. W.	Calm.	N. 26 W.	0. 0	13. 4	0. 0	5. 94	6. 15	.....	.....
20	......	......	......	......	......	......	......	......	......	.....	.....	.....	.....	.....		.....	.....	Calm.	S.	Calm.	S. 5 E.	0. 0	0. 4	0. 0	0. 03	0. 15	.....	.....
21	. 615	. 593	. 625	. 6160	46. 7	61. 1	51. 7	52. 02	+ 7. 22	. 268	. 355	. 312	. 306	83	66	81	79	S. W.	S. W.	Calm.	S. 40 W.	2. 0	8. 0	0. 0	2. 45	2. 47	.....	.....
22	. 633	. 637	. 862	. 7265	47. 0	62. 5	48. 1	50. 67	+ 6. 10	. 283	. 363	. 278	. 293	88	64	83	80	Calm.	S. W.	N. W.	N. 45 W.	0. 0	5. 9	4. 2	3. 06	4. 42	. 010	.....
23	. 970	30. 062	30. 141	30. 0725	42. 3	50. 3	39. 4	44. 00	— 0. 32	. 230	. 170	. 168	. 188	85	47	69	66	N.	N.	N.	N. 10 W.	7. 8	5. 0	5. 0	5. 69	5. 89	.....	.....
24	30. 154	30. 120	30. 030	30. 0940	35. 5	49. 5	36. 9	41. 67	— 2. 38	. 176	. 221	. 184	. 196	85	62	84	75	N. E.	E.	Calm.	N. 56 E.	3. 0	8. 0	0. 0	2. 25	3. 20	.....	.....
25	29. 940	29. 816	29. 694	29. 8012	45. 6	52. 1	48. 8	49. 25	+ 5. 45	. 291	. 320	. 330	. 318	95	82	95	90	N. E.	E.	N. E.	N. 71 E.	0. 6	8. 8	7. 8	5. 57	5. 67	. 160	.....
26	. 471	. 361	. 341	. 3828	50. 6	51. 0	48. 5	49. 97	+ 6. 38	. 361	. 372	. 324	. 352	98	99	95	98	N. E.	N. E.	N.	N. 36 E.	9. 4	4. 2	4. 4	6. 63	6. 82	1. 290	.....
27	......	......	......	......	......	......	......	......	......	.....	.....	.....	.....	.....		.....	.....	N.	N.	N.	N. 7 E.	4. 6	11. 8	7. 4	6. 26	6. 29	. 200	.....
28	. 875	30. 000	30. 104	30. 0115	36. 9	47. 7	37. 6	40. 45	— 2. 65	. 192	. 186	. 183	. 186	87	56	81	75	N. E.	S. E.	N. E.	N. 50 E.	6. 4	7. 3	4. 6	3. 70	4. 48	.....	.....
29	30. 166	30. 173	30. 149	30. 1638	35. 1	47. 0	44. 8	42. 55	— 0. 32	. 182	. 223	. 224	. 198	89	68	75	72	N. E.	E.	E.	N. 72 E.	5. 0	7. 6	6. 5	4. 59	5. 34	.....	.....
30	30. 068	29. 976	29. 860	29. 9542	39. 4	49. 9	46. 3	45. 32	+ 2. 68	. 202	. 204	. 204	. 213	83	56	64	70	N. E.	E.	S. E.	S. 81 E.	0. 4	7. 0	9. 0	5. 75	5. 84	.....	.....
31	29. 779	. 686	. 651	. 7012	40. 9	47. 4	36. 2	40. 47	— 1. 95	. 211	. 190	. 167	. 179	82	58	78	72	S. E.	E.	Calm.	S. 47 E.	1. 1	5. 0	0. 0	1. 38	1. 50	.....	.....
	29. 6981	29. 6798	29. 7016	29. 6940	41. 31	51. 59	43. 53	45. 55	— 0. 74	. 235	. 252	. 235	. 240	88	64	81	77	....	....	....	....	3. 23	8. 42	2. 76	.....	4. 59	3. 288	Inap

Comparative table for October.

Year.	Temperature.					Rain.		Snow.		Wind.		
										Resultant.		
	Mean.	Excess above average.	Maximum.	Minimum.	Range.	Number of days.	Inches.	Number of days.	Inches.	Direction.	Velocity.	Mean velocity.
	°	°	°	°	°					°	°	
1844	43.3	− 2.6	71.6	15.9	55.7	7	Imp...	4	12.0	....	......	0.43 lbs.
1845	46.4	+ 0.5	64.0	19.7	44.3	11	1.760	1	Inap.	....	......	0.26
1846	44.6	− 1.3	70.1	20.7	49.4	14	4.180	2	Inap.	....	......	0.44
1847	44.0	− 1.9	64.6	20.4	44.2	13	4.390	2	Inap.	....	......	0.19
1848	46.3	+ 0.4	61.8	24.5	37.3	11	1.550	0	0.0	N 54 W	1.24	4.60 mls.
1849	45.3	− 0.6	58.9	24.2	34.7	13	5.965	1	Inap.	N 12 W	1.27	7.76
1850	45.4	− 0.5	66.7	22.4	44.3	10	2.085	0	0.0	N 66 W	1.10	5.30
1851	47.4	+ 1.5	66.2	25.2	41.0	10	1.680	2	0.3	S 72 W	1.06	4.39
1852	48.0	+ 2.1	70.7	23.8	46.9	12	5.280	0	0.0	N 5 E	1.19	4.47
1853	44.4	− 1.5	64.7	23.4	41.3	10	0.875	2	Inap.	S 88 W	1.74	4.77
1854	49.5	+ 3.6	75.4	26.4	49.0	15	1.495	3	Inap.	N 45 W	1.52	4.57
1855	45.4	− 0.5	68.0	22.6	45.4	14	2.485	5	0.8	N 82 W	4.91	9.88
1856	45.3	− 0.6	71.4	23.0	48.4	10	0.875	2	0.1	N 76 W	2.15	6.07
1857	45.4	− 0.5	64.0	26.5	37.5	10	1.040	2	0.2	N 19 W	2.93	6.24
1858	48.8	+ 2.9	76.3	31.5	44.8	17	1.797	1	Inap.	N 34 W	0.36	5.96
1859	43.0	− 2.9	69.8	22.3	47.5	11	0.940	4	Inap.	N 68 W	5.04	8.12
1860	47.3	+ 1.4	68.0	28.4	39.6	15	1.618	1	Inap.	N 9 W	2.00	6.93
1861	48.7	+ 2.8	71.0	29.0	42.0	15	1.993	1	Inap.	N 61 W	1.06	5.96
1862	48.7	+ 2.8	76.6	26.2	50.4	19	2.684	2	0.5	N 78 W	2.89	6.53
1863	45.9	0.0	66.4	30.5	35.9	16	2.522	0	0.0	S 71 W	0.48	6.16
1864	45.2	− 0.7	67.0	28.0	39.0	22	3.321	1	Inap.	N 60 W	3.17	6.66
1865	44.5	− 1.4	71.4	21.6	49.8	17	2.705	3	4.5	N 36 W	3.35	7.26
1866	49.1	+ 3.2	71.0	31.8	39.2	11	2.470	1	Inap.	N 30 W	0.84	5.53
1867	49.9	+ 4.0	75.4	31.0	44.4	11	1.970	0	0.0	N 45 W	1.51	5.73
1868	42.4	− 3.5	67.6	24.0	43.6	10	1.365	2	2.0	N 89 W	1.27	7.10
1869	42.3	− 3.6	69.8	18.7	51.1	8	0.962	7	2.3	N 89 W	3.72	6.73
1870	50.0	+ 4.1	68.5	30.2	38.3	16	2.690	0	0.0	N 85 W	1.86	7.11
1871	48.3	+ 2.4	72.2	28.6	43.6	13	1.185	0	0.0	S 66 W	3.75	7.84
1872	45.6	− 0.3	70.0	25.2	44.8	14	3.288	1	Inap.	N 18 W	2.22	4.59
Results to 1871	45.86	....	68.90	25.02	43.88	12.50	2.389	1.81	0.87	N 64 W	1.82	6.20
Excess for 1872	−0.31	....	+1.10	+0.18	+0.92	+1.50	+0.899	−0.81	−0.87	....	......	−1.61

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1871.

NOTE.—The monthly means do not include Sunday observations. The daily means, excepting those that relate to the wind, are derived from six observations daily, namely, at 6 a. m., 8 a. m., 2 p. m., 4 p. m., 10 p. m., and midnight. The means and the resultants for the wind are from hourly observations.

Highest barometer....................30.042 at 8 a. m. on 13th } Monthly range = 0.879.
Lowest barometer....................29.163 at midnight on 3d }

Self-registering thermometer.
- Maximum temperature....................72° 2 on 22d } Monthly range = 43°6.
- Minimum temperature....................28° 6 on 31st }
- Mean maximum temperature....................58° 26 } Mean daily range = 17° 50.
- Mean minimum temperature....................40° 76 }
- Greatest daily range....................30° 8 from p. m. of 18th to p. m. of 19th.
- Least daily range....................8° 3 from a. m. to p. m. of 6th.

Warmest day, 5th....................mean temperature 56° 72 } Difference = 18°10.
Coldest day, 20th....................mean temperature 38° 62 }

Maximum radiation { Solar....................82° 2 on 22d } Monthly range = 62°4.
{ Terrestrial....................19° 8 on 7th }

Aurora observed on 3 nights, viz: 6th, 16th, and 17th.
Possible to see aurora on 15 nights; impossible on 16 nights.
Raining on 12 days; depth, 1.185 inches; duration of fall, 30.2 hours.
Mean of cloudiness, 0.68.

WIND.

Resultant direction, S. 66° W.; resultant velocity, 3.75 miles.
Mean velocity, 7.84 miles per hour.
Maximum velocity, 36.0 miles, from 8 to 9 a. m. of 15th.
Most windy day, 19th; mean velocity, 17.41 miles per hour.
Least windy day, 7th; mean velocity, 2.42 miles per hour.
Most windy hour, 2 p. m.; mean velocity, 12.73 miles per hour.
Least windy hour, 1 a. m.; mean velocity, 4.40 miles per hour.
Fog recorded on 9 occasions during month.
Solar halo, 9th; lunar halo on 24th and 30th.
Thunder-storms on 5th and 26th; rainbows on 1st and 18th.
21st, large meteor in W. at 8.30 p. m., color bright blue.
Particles of snow are reported to have fallen on the afternoon of the 17th in the university grounds.

REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1872.

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Highest barometer	30.194 at 8 a. m. on 29th	Monthly range = 0.968.
Lowest barometer	29.226 at midnight on 15th	
Self-registering thermometer. Maximum temperature	70°0 on 6th	Monthly range = 44°8.
Minimum temperature	25°2 on 20th	
Mean maximum temperature	54°11	Mean daily range = 16°98.
Mean minimum temperature	37°13	
Greatest daily range	25°6 from a. m. to p. m. of 3d.	
Least daily range	5°0 from a. m. to p. m. of 26th.	
Warmest day, 6th	mean temperature 56°63	Difference = 18°91.
Coldest day, 19th	mean temperature 37°72	
Maximum radiation, Solar	125°0 on 3d	Difference = 108°0.
Maximum radiation, Terrestrial	17°0 on 20th	

Aurora observed on 9 nights, viz: 1st, 2d, 3d, 5th, 7th, 14th, 16th, 28th, and 29th.
Possible to see aurora on 21 nights; impossible on 10 nights.
Raining on 14 days; depth, 3.288 inches; duration of fall, 73.8 hours.
Mean of cloudiness = 0.51.
Snowing on 1 day; depth inappreciable; duration of fall, 0.5 hour.

WIND.

Resultant direction, N. 18° W.; resultant velocity, 2.22 miles.
Mean velocity, 4.59 miles per hour.
Maximum velocity, 29.2 miles, from 7.30 to 8.30 a. m. of 16th.
Most windy day, 14th; mean velocity, 15.19 miles per hour.
Least windy day, 20th; mean velocity, 0.15 miles per hour.
Most windy hour, 2 p. m.; mean velocity, 8.42 miles per hour.
Least windy hour, 11 p. m.; mean velocity, 2.54 miles per hour.
First snow of the season on 14th.
Fog on the 5th, 9th, 18th, and 20th.
Thunder on the 6th and 15th.
Lightning on 6th.
Lunar halo on 11th.
The auroral display on the 14th, was very brilliant, and accompanied by considerable magnetic disturbance.

Fogs.—Remarkably acrid or fetid fogs have been observed to proceed or accompany some epidemics of influenza. Dr. Arbuthnot remarks on the prevalence of fogs, not only in England but in France and Germany as well, in connection with the influenzas of 1727 and 1732–'33. In the latter year there had been a severe drought, wells were dry, and from November 4 till Christmas there prevailed stinking fogs, a higher temperature than usual, great storms of wind from the southeast, and lightning without thunder. It was further observed by surgeons that wounds showed a great disposition to mortify. But in the great majority of influenza epidemics and epizootics there has been no such coincidence. The present equine affection has neither been preceded nor attended by any such phenomenon. Fogs appeared on but three days, 6th, 11th, and 18th of September, 1872, whereas they existed on six days, 1st, 4th, 5th, 13th, 16th, and 19th of September, 1871. Fogs and vapors, impregnated with sulphurous gases or other bad smelling or putrefying elements, would undoubtedly undermine the general health, and favor the diffusion of such a disease as influenza; but the origin and course of the present epizootic, like that of the majority on record, shows clearly enough that no such condition is essential to its development.

Rain-fall and humidity.—The rain-fall for September, 1872, at Toronto, was but 2.526 inches, as compared with 1.290 inches in September, 1871, and 6.794 inches in September, 1870. The rainy days were sixteen in 1872, against eight in 1871, and seventeen in 1861. The total rain in September, 1872, was 1 inch below the average of the twenty-eight preceding years.

The average relative humidity of the air, in Toronto, in September, 1872, was 78, against 71 for the same month of the previous year. Though greater than in the former year, this is by no means an excess

of moisture, and any assumed importance of this excess will be destroyed by a reference to the following table giving the relative humidity of the air at other places, where influenza did not appear during September, 1872. For part of this table, and for other facts in connection with the weather, I am indebted to Brigadier-General Myers, Chief Officer of the Signal-Service, who kindly furnished the monthly meteorological reports:

Relative humidity per cent. for September, 1872.

Weeks.	Toronto.	Montreal.	Quebec.	Detroit.	New York.
First	73.7	76.5	78.5	70.7	64.4
Second	80.6	79.7	83.0	79.0	79.7
Third	79.5	76.8	82.6	72.0	75.5
Fourth	77.8	74.7	76.0	66.4	81.0
Average for four weeks	77.9	76.92	80.02	72.02	75.15

The barometer had a low average for September, 1872, at Toronto—29.5937, against 29.7200 of the same month in 1871. Its range, too, was less, 0.728, against 0.799 in September, 1871. The average heights of the barometer, at Toronto, in June, July, and August, 1871, were respectively 29.5431, 29.5552, and 29.5780.

Ozone.—It has been strongly contended that this agent is in excess in the atmosphere during epidemics of influenza. Since Shöuleim placed a rabbit for an hour in an atmosphere artificially charged with ozone, and found a resulting inflammation of the mucous membranes, and death of the subject a few hours later, the potency of this agent in causing influenza has been largely assumed. Additional weight was given to the theory by the observations of Bœckel, of Strasburg, who found that an excess of ozone in the atmosphere, if associated with cold east or northeast winds, or snow, was capable of inducing inflammation of the air-passages. Bœckel further found that when he compelled animals to breathe strongly ozonized air, lobular pneumonia was produced. (Levy.) But there is no evidence that the catarrhs and pneumonias thus produced were capable of extending and assuming the character of an epidemic. It is found, indeed, that ozone does not exist in an atmosphere loaded with organic impurities, the product of putrid decomposition, or of animal respiration. Bêrigny could find no indication of the presence of ozone in the surgical, fever, and venereal wards of the military hospital at Versailles, though it was abundant in the court-yard of the hospital. James fonnd a great deficiency in the military hospital at Sedan, as compared with the garden of the hospital. Bœckel found it in abundance on the platform of the cathedral at Strasburg during the prevalence of cholera in that city; but he rarely found a trace in the streets of the town. He further asserts, as the result of his observations, that in air charged with paludal emanations ozone is not produced. He was moreover unable to develop ozone to any extent in a cholera ward.

But these are precisely the conditions in which influenza assumes its greatest severity and shows the highest death-rate. In the large cities, where the air contains an excess of carbonic acid, given off by fires and animal lungs, and an abundance of organic matter, the products of wash and decay in organized bodies, this is unquestionably the case. And just in proportion to the squalor, the filth, the impurity, and the absence of a proper hygiene, so does the affection prove more severe

and fatal. So it is in the close, unventilated, and undrained, or underground stables of cities, with air loaded to suffocation with the products of respiration and putrefaction. In these the mortality proves far in excess of that of the horses in the better-appointed stables, or in the country. A review of the whole subject shows very conclusively that an excess of ozone in the atmosphere cannot be accepted as the one cause, or the main cause, of influenza.

Again, it is difficult to estimate the amount of ozone in the air. Nitrous acid, which often exists in great amount near the surface of the earth, which, like ozone, is produced in large quantities during thunder-storms, and like it decomposes organic matter in the air, has precisely the same reaction with ozone on iodized starch papers. Ozone, moreover, is always present in larger amount at the higher altitudes, but influenza shows no such predilection for the hills. It has, on the other hand, during the recent epizootic, shown a decided preference for the valleys, along which run the great railroad-tracks, as evinced by its earlier *debut* in such places. Again, the amount of ozone varies constantly on the sea-shore from the great evaporation and the ever-changing condition of the electricity, and a sea-side residence has been accordingly advised as a safeguard against the evil effects of an excess of ozone.

But the recent epizootic had its origin near the border of a large lake, and has in the main prevailed earlier and more severely in the large towns on the Atlantic sea-board than in inland districts. As examples, may be mentioned New York, Brooklyn, Jersey City, and Boston, attacked on or about October 22; Portland, Maine, Newport, Rhode Island, and New Haven, Connecticut, October 23; Portsmouth, Virginia, November 1; and Charleston, South Carolina, November 2; whereas it only appeared in Washington County, and Kingston, New York, on November 1; Cooperstown on November 6, and in Scranton, Forest County, Clearfield County, and elsewhere in Pennsylvania about November 14. Dropsies and other dangerous complications were also very prevalent in these sea-board cities.

Through the favor of Professor Kedzie, of the Michigan State Agricultural College, I am enabled to present the following letter, embodying his observations on the amount of atmospheric ozone before and during the prevalence of the disease:

MICHIGAN STATE AGRICULTURAL COLLEGE,
Chemical Department, Lansing, December 16, 1872.

DEAR SIR: Your favor of 11th instant, asking information in regard to the amount of atmospheric ozone observed at this place in connection with the influenza in horses, is received, and it gives me great pleasure to comply with your request.

The observations on atmospheric ozone have been taken at this college only during two years—a narrow ground for any broad generalizations. The observations are taken twice a day, viz, from 7 a. m. to 2 p. m., the day observations; and from 9 p. m. to 7 a. m., night observations. They are taken by exposing a slip of Schonbein's test-paper (moistened) to the air in a shady place, but freely exposed to the air. At the close of the observation the paper is again moistened with distilled water and compared with the scale. The scale has for its extremes the slightest perceptible shade of purple, which is marked 1, and the deepest purple-blue characteristic of iodide of starch, marked 10, the space between 1 and 10 being toned to give gradation of the scale. The place of observation is such as gives pure country air. The night observavations give a larger amount of ozone for two reasons: 1st, the greater length of time, and 2d, the larger amount of atmospheric moisture.

Immediately preceding the epizootic, a marked increase of ozone was observed—so marked as to call special attention to the fact. During September the average amount of ozone by day was 1.40, and by night 1.86; for October, 1.93 by day, and 3.18 by night, with *a rapid increase during the last three days of the month.* Early in November the disease made its appearance, and during this month the averange of ozone by day was 4.60, and by night 6.17. The average of December to this date is 5.56 by day, 6.66 by night. A comparison of the amount of ozone during corresponding periods of 1871

is as follows: September, by day 1.58, by night 2.65; October, by day, 1.64, by night 1.96; November, 3.70 by day, and 4.06 by night; December to the 16th instant, by day, 1.91, and by night 3.16. The excess of ozone for November, 1872, over November, 1871, is .90 by day and 2.11 by night; and for corresponding periods of December, 1872, over December, 1871, is, by day, 3.65, and by night, 3.50.

The disease is rapidly closing up business here, apparently for want of raw material.

Very respectfully, yours, &c.,

R. C. KEDZIE.

Professor LAW.

In view of this extraordinary excess of ozone at Lansing during the influenza period, it is much to be regretted that comparative observations are not obtainable from all parts of the continent. That the ozone has been generally in excess is possible, and that it lays the system open to the attack of the specific poison is not at all unreasonable, but it cannot be looked upon as the one and essential cause of the disease. If it were, why has the soliped been the only victim, since man has often shared the calamity on previous occasions? And, above all, why has the disease in every instance pursued a regular progress over the land in keeping with the facilities for rapid transit? The proofs of contagion furnished below entirely destroy the doctrine of the pathogenisis of the disease by a general excess of ozone. If ozone is in excess everywhere, and has any connection with the disease, it must either be a result of the propagation of the poison, or only an accessory cause, operating by weakening the system and laying it open to the attack of a poison which would otherwise remain powerless.

Electricity.—No reports of the state of the atmospheric electricity are to hand, but, like ozone, if potent at all, it could only be so in producing the first case or cases. It might be conceived of as affecting the nutrition of the animal body, so as to produce from its elements a morbid poison capable of indefinite reproduction, and of communicating the disease from animal to animal. But to conceive of the same electrical condition spreading by slow and steadily advancing steps over the continent for the space of three months, in all the varied phases of altitude and the opposite; of rain, snow, and fair weather; of clouds and sunshine; of atmospheric moisture and dryness; of storm and calm, in city and country, on the inland, table-land, and valley, and on the sea-shore, is not in keeping with what we know of this agency.

According to Peltier, the electricity of the earth is always *negative*, and that of a dry atmosphere *positive*. Gay-Lussac and Biot found that the greater the altitude they attained in a balloon, the stronger was the positive electricity. Becquerel and Breschit found no evidence of positive electricity in the six feet nearest to the surface of the earth, in close-sheltered places, in the court-yards of houses, in the streets of cities, or in narrow valleys. In a calm, pure atmosphere the electricity is uniformly disseminated, and therefore little marked, but with a lowering of temperature and the condensation of the contained watery vapor into more or less dense clouds, the electricity concentrates itself around the watery particles and leads to extensive disturbances of the equilibrium. The action of the earth renders these clouds more negative in their upper than in their lower parts. Water falling in rain is as often positive as negative; falling as snow, it is positive four times in every five. Slight rains do not modify the atmospheric electricity, while heavy rains increase it positively or negatively. The approach of a hail-storm determines great inequalities in the electric tension of the air; strong winds also seriously disturb the equilibrium. It has been stated that rains occurring during south, southeast, and southwest winds are mostly negative, while those with

north, northeast, and northwest winds are more frequently positive. (Levy.) Setting aside the regular diurnal variations, it follows that in the same latitude—location—the proximity of trees or buildings, the force and direction of the prevailing winds, the existence or non-existence of clouds, and the occurrence of heavy rain, hail, or snow, mainly affect the atmospheric electricity. Some approximation to the electrical disturbance might, therefore, be attained by noting some of these conditions during the month. The resultant direction of the winds during September, 1872, at Toronto was north 79° west, and in September, 1871, north 74° west. The mean velocity for the month was 5.24 miles per hour in 1872, and 5.50 miles per hour in 1871. The maximum velocity in September, 1872, was twenty-nine miles; in 1871, twenty-six miles. In September, 1872, twenty days had each a less average than six miles per hour, while ten days each averaged from six to ten miles. In September, 1871, eighteen days individually averaged under six miles per hour, while twelve days had averages ranging from this up to ten miles. Rain fell on sixteen days of the month in 1872, the total duration of fall being 43.4 hours. It fell on eight days in 1871, the duration of fall being 27.7 hours. The observations made thrice daily in September, 1872, at Toronto, report the weather in twenty-nine instances cloudy, three times hazy, one time foggy, three times threatening, five times a light rain, and one time a heavy rain. It is twenty-six times reported clear. It was marked calm on twenty-eight occasions, seven times calm and clear, fourteen times calm and cloudy, and seven times calm and foggy.

It is manifest, from these data, that there must have been considerably more disturbance of the electrical tension during September last, in Toronto, than during the same month of 1871, and the frequency of thunder and lightning testifies to the same truth. September, 1872, had thunder or lightning on the 5th, 6th, 7th, 8th, 12th, 18th, 19th, 22d, 23d, 26th, and 29th. September, 1871, had thunder reported on the 3d, and thunder and lightning on the 18th. I have not before me the report of the thunder-storms at Toronto for the earlier months of 1872, but for 1871 there are but six storms reported for July, six for August, and three for June. Altogether, there appears to be testimony to an existence of an unusual amount of disturbance of the electrical equilibrium in September, 1872; but whether this is sufficient to account for the *origin* of influenza may still be disputed. It is needless to deny how man and beast often suffer during the prevalence of the electrical disturbances, and especially just before the bursting of a thunder-storm. And considering how the nuclei (nutritive centers) of the different animal tissues have their functions arrested or perverted by inflammatory action; and considering further the varied development of many of the lowest organisms, when placed in different circumstances, it does not seem very irrational to assume that under varying conditions of electrical action, and of other attendant circumstances, there may be developed from these ultimate living particles of the animal body, or from vegetable organisms, new organic particles, with novel and pathogenic properties, and capable of multiplying indefinitely and disseminating a specific disease. But there is no evidence that this is really the case. We have merely the coincidence of extensive electrical disturbances, and the outbreak of the influenza of 1872. With regard to former epidemics, Dr. Parkes says that "no evidence has been collected which shows any connection with conditions of telluric magnetism or atmospheric electricity, and, indeed, the peculiar spread and frequent localization of influenza seem

inconsistent with general magnetic conditions." And how often do we see thunder-storms occurring day after day for a length of time without the supervention of influenza. It is not at all improbable that this electric condition of the atmosphere had something to do with the development of the epizootic; but in view of all the known facts, and of our experience of the past, we can only look on it as predisposing the system to the attack of a poison which previously existed, but had remained latent for want of a receptive subject. Considering the feverish condition of the system in times of great electric tension, the amount of ozone resulting from electric discharges, and the known action of ozone on the respiratory mucous membrane, the doctrine is at least plausible that the diseased condition and lowered vitality of this membrane at such a time laid it open to the attack of the poison. But in support of this theory as universally operative, we must assume either a supervention of this electrical derangement at each place whenever an animal is attacked, or that the reception of the poison into the animal body changes its character and intensifies its virulence. This gradual march of the electric tension over the continent seems an extravagant and unwarrantable assumption. The acquisition of increased potency or virulence, by passing through an animal body, is not altogether incompatible with what we know of the varied development of some of the lower forms of life in different media.

It will be observed that this hypothesis of the etiological importance of electricity and ozone does not touch the question of the primary origin of the poison. It assumes the poison to be already in existence, and that these agencies merely lay the system open to receive it, as do impure air, exhaustion, unsuitable food, and other health-depressing causes. Whatever the significance of the electrical disturbances at Toronto in September, the fact ought to be recorded for the guidance of future observers.

Progress from east to west or from west to east.—The old doctrine was that influenza always extended from east to west, as it had been repeatedly traced over Asia into and through Europe. The epidemics of 1781, 1800, and 1833, were remarkable examples of this. Yet it has often followed an opposite course. The epidemic of 1768 prevailed in America before it reached Europe, and Webster claims the same course for those of 1757, 1761, and 1781. Gluge, from an induction of all the epidemics known to have occurred for three hundred years, concluded that the general course was from west to east. The recent equine influenza has spread from Toronto in a direction east, west, and south, and indeed any conclusions based on the direction pursued by the malady must be given up.

Contagion.—Is there a specific *contagion?* This is manifestly a question of vital importance with reference to the influence of the above alleged causes. If there is a *contagion* which may exist in the body of the sick animal, increase there, and be the means of communicating the malady to an indefinite number of sound stock, all our theorizing on noxious gases and putrid fogs, inclemencies and extreme vicissitudes of the weather, excess of ozone, magnetic disturbance, and the like, will be of small account. Indeed no one of the conditions we have been considering, nor all of them put together, can explain the regular progress of such as the recent epizootic, step by step, from a given point of origin, over the whole Atlantic slope of the continent, extending over a period of three months, and without being materially influenced by locality, soil, altitude, weather, or climate. No such condition will

explain the fact that horses only have suffered, while all the animal creation beside have escaped. In other great epizootics man has often suffered at the same time with the horse. If these resulted from atmospheric changes alone, how comes it that man has escaped now? The explanation would be easy if the equine and the human malady were alike due to specific *contagia*, distinct from each other, but closely allied in their manifest results and in the conditions which favor their development or reproduction. Were the morbific element a simple gas, it would be excessive in amount and easily appreciable at the point of origin; it would continue to exert its influence at this point if its production lasted; it would expend its power there, and advance by successive steps over newly conquered territory, each to be as promptly relinquished in its turn; and unless uniformly diffused through the atmosphere and in all parts of the globe, it would be speedily diluted and rendered inert as it spread from its center of origin. The same remarks would apply to putrefying organic matter in the atmosphere. This would soon be changed by the action of oxygen into new compounds, and lose its original properties. It would be easily appreciable in the atmosphere, and would soon expire by its own limitation, and by the completion of the putrefactive process. The only theory that will accord with the history of the malady and its steady increase and extention is that which recognizes the existence of a *contagion*, capable, like other specific disease poisons, of assimilating its appropriate food, of reproducing its elements, and of thereby increasing the area of the disease.

The present visitation has shown an unmistakable tendency to progress most rapidly along the great lines of commerce and travel. It broke out near Toronto in the latter part of September; was reported in the city on October 1, and a fortnight later had reached Montreal and Quebec. Before the 13th October it had reached Detroit, by the 14th Buffalo, and by the 17th Rochester. By the 19th it existed in Lockport, Canandaigua, Geneva, Syracuse, and Albany, and a few days later in Auburn and Utica; by the 22d it had reached Boston and Revere, Massachusetts; Lewiston, Maine; and New York, Brooklyn, and Jersey City; on the 23d it had appeared in Hartford and New Haven, Connecticut; Providence and Newport, Rhode Island; Lunenburgh, Vermont; and Bangor, Portland, and Augusta, Maine. Yet it only reached Kingston, on the opposite side of the Hudson from that occupied by the railway, on November 1, and Cooperstown, Otsego County, New York, well removed from all railroad privileges, on November 6, though apparently in the direct line of the atmospheric wave, had such been the grand cause of the disorder. It followed, in short, the course of the New York Central and Hudson River Railroads and their various connecting lines, while sparing the towns at some distance from the track. Passing south, we find it in Philadelphia, Baltimore, and Washington by October 28, while the places already referred to in New York were still sound, though for some time past surrounded on all sides by the disease. It soon gained Goldsborough, North Carolina, and Columbia, South Carolina, on November 3, three days before its advent at Cooperstown, New York, ten days before its appearance at Scranton, eighteen days before it pervaded Blair County, Pennsylvania, and at the same dates when the malady was making its way down the Hoosic Valley, Massachusetts. Taking the course of the Erie Railroad from Buffalo, we find the affection prevailing in Wyoming and Steuben Counties, New York, on October 21, Elmira and Binghamton by October 28, and Warren County, Pennsylvania, by October 20, while Ithaca, New York, only suffered on

October 31, and the country to the east of it a week or two later. It is needless to follow this subject farther. In the West the same truth is equally manifest. Not only do we find a tendency to follow the great lines of rail, but in many cases a temporary avoidance of many of the small towns on the track, whose commercial relations are less active, and their danger of infection correspondingly small.

It only remains to be determined whether the disease will spread in a new locality from a newly imported sick animal as a center. If it can be introduced in this way into a new locality, well out of the former area of the disease, and spread promptly from the imported sick animal as a center, it must be possessed of a specific *contagium*. Were the body merely charged with noxious gases, with decomposing organic matter, or with electricity, it could never become the center for a wide diffusion of a specific disease. These agents would soon pass from the system and lose their noxious qualities by diffusion or decomposition. The presence of the sick animal would be no more injurious than a chemical laboratory, a putrid carcass, or an electric machine.

Attention is called, then, to the following facts: The first cases in Detroit were several sick horses brought from Canada, about the 10th or 11th of October; others were attacked in less than two days, and the malady appears to have been confined for nearly a week to the two stables into which the Canadian beasts were brought. The first cases in Syracuse were in newly arrived Canadian horses, and the malady spread promptly in city and country. The earliest cases which I have been able to trace in Ithaca were in the livery-stables of Mr. Jackson, who had just returned from running a mare in a more northern part of the State. In Pittsburgh the disease first appeared in the stables of Messrs. Moreland & Mitchell after the arrival of five or six horses from New York, when the epizootic was then at its height. In every instance it spread rapidly in the new locality. From Washington the first note of alarm was sounded on October 28th, to the effect that sick horses had been brought into the city from the North, and on November 31 it was reported to be generally prevalent. In Lehigh County, Pennsylvania, the malady appeared about November 4, and spread like fire along the canal and into the surrounding country. On November 19 it prevailed at points in Giles, Rutherford, Maury, Davidson, and Sumner Counties, Tennessee, which had been recently visited by a circus, coming from an infected locality, and while the general district was free. At Newark, Delaware, the first case was in a horse just arrived from Baltimore, and others speedily followed. At Elyria, Ohio, it was confined for five days, and for five days only, to teams just back from Cleveland.

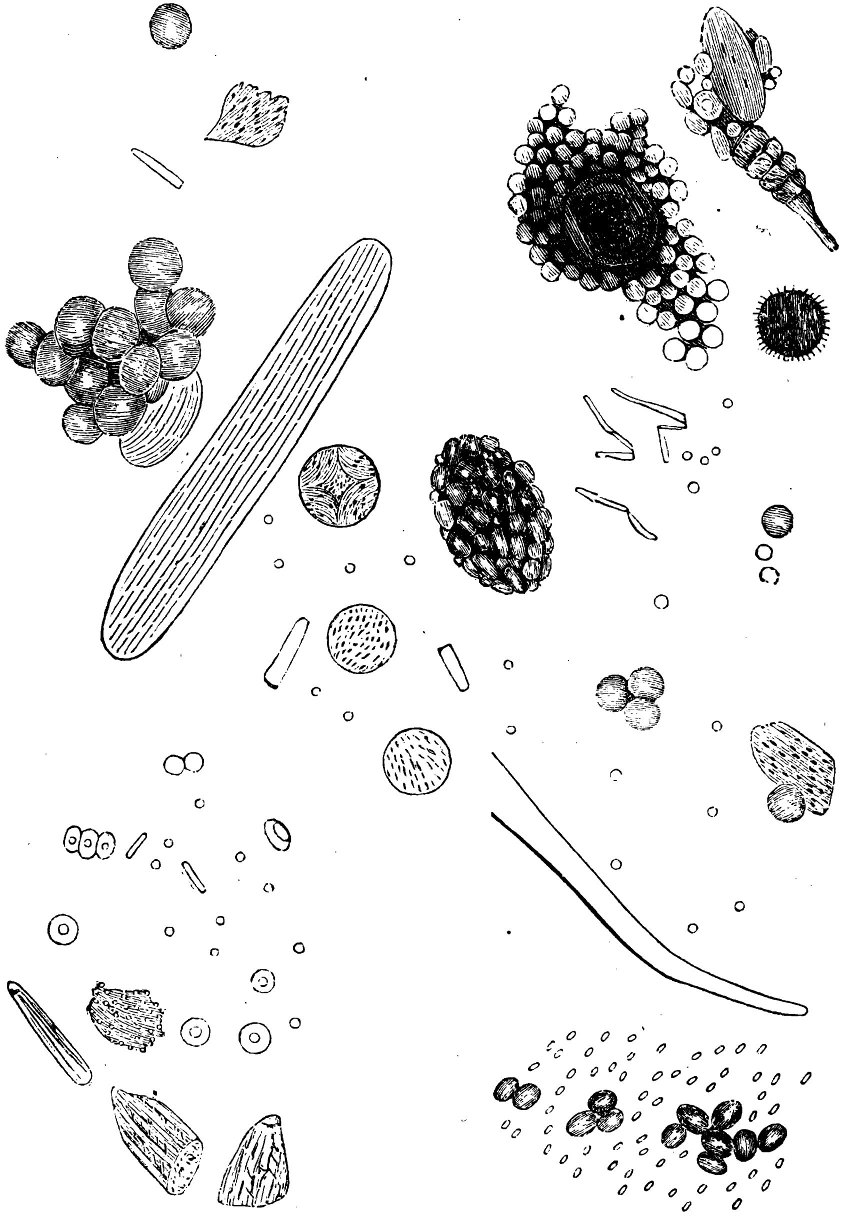
Most of these were instances of the appearance of the disease in an entirely new locality, far beyond the limits of the region formerly pervaded by the disorder, and from such new points the infection spread widely before the general country, or even many of the towns in the interval between this and the former diseased area were involved.

Instances of the same kind could easily be adduced from the history of former epizootics. In influenza in man similar observations have been made by such authorities as Barker, Haygarth, Williams, Parkes, and Sir Thomas Watson. Persons just arrived from an infected place have so frequently proved the center for a new diffusion of the poison that some have attempted to trace all cases to contagion alone.

It will be objected to this doctrine that Hertwig's inoculations, and even the transfusion of blood from a sick to a healthy horse, has failed

to transmit the disease. In the face of such testimony as is furnished above, the conclusiveness of this evidence may be safely denied. Every individual is not susceptible. I can point to horses which have been freely exposed in the streets, and have even stood in the stalls just

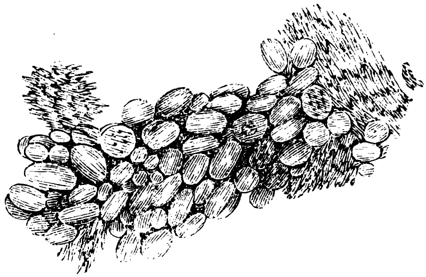
Fig. 39.



vacated by the sick horses, and have yet completely escaped the disease. The argument from transfusion is no more conclusve than was

the failure of the blood of cholera patients to induce that disease in healthy men. It does not disprove the existence of a poison, but merely that the subject was an unsusceptible one, or that the poison is not present in the blood.

Fig. 40.



Nature of the contagion.—The existence of a contagion being acknowledged, the question next arises as to its nature. We are left to choose between two theories: First, that which recognizes in fungi and other low organisms the specific poison; and, second, that which seeks the pathogenic element in the infinitesimal granules of organic matter, found floating in the infecting atmosphere, as well as in the solids and fluids of the animal body.

The first-named theory is open to the objection that no specific vegetable germs have been found in the air, blood, or nasal discharges during the prevalence of influenza. Before the advent of the recent epizootic at Ithaca I subjected the floating elements in the air obtained in stables and field to microscopic observation, and repeated the observations while the affection was advancing to its climax. Spores were found abundantly, of the forms represented in Fig. 39, but the same were found before and after the arrival of the disease. The mucus from a sick horse's nose contained similar spores, and the dust obtained by shaking a handful of hay taken from the interior of a hay-mow, after the influenza had subsided, showed them in great abundance. The objects in the air were obtained by drawing it through an aspirator and directing the current on a drop of glycerine on a glass slide. The mucus and blood from diseased horses were received on a glass slide, and immediately covered. The dust from hay was allowed to fall on a glass slide, with a drop of glycerine, and immediately covered. The objects shown in Fig. 40 were deposited on a glass slide, with a drop of glycerine, exposed for a night in a field near a house.

Fig. 41.

I append the report of observations conducted by Mr. Taylor, microscopist to the Department of Agriculture; and another of observations made by Dr. Jackson, Columbia, South Carolina.

REPORT ON OBSERVATIONS BY THE MICROSCOPIST OF THE DEPARTMENT OF AGRICULTURE.

To the Commissioner of Agriculture:

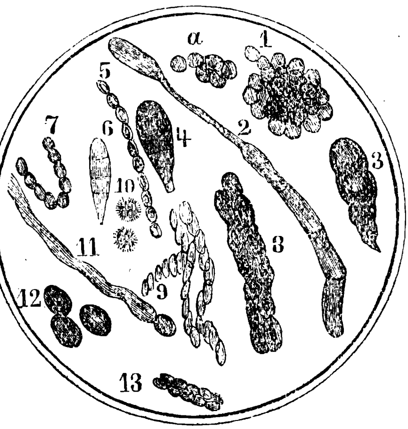
SIR: In accordance with your instructions, I have made a microscopic examination of the mucus flowing from the nostrils of several horses suffering from the prevailing horse influenza.

On the 4th instant I collected mucus from the nostrils of five horses suffering from the malady, and submitted a portion of each to a power of about 50 diameters, when the entire field appeared covered with spore-like germs, gelatinous and semi-transparent. Under a power of about 600 diameters they appear as disks, some of which, under favorable conditions, may be seen moving on their edges. Perfect and imperfect cells were combined in a mass. All exhibited dotted markings. After the

application of various tests, I came to the conclusion that they were mucus cells in combination with normal mucus.

A few fungi spores were frequently seen during my investigation, combined with mucus cells and normal mucus; but as its gelatinous character prevented minute observations, I decided to submit portions of the mucus of each horse to the action of caustic-potash for several hours, at a temperature of about 100° Fahrenheit. By this process all the animal matter (normal mucus and mucus cells) was dissolved. I next added aqua ammonia to the solution to render the mass more liquid, and placed it aside to settle. In the course of twenty-four hours a sediment appeared at the bottom of each test-tube. The alkalies were removed in some cases by washing, and in others I secured the sediment by evaporation. Portions of the sediment of the mucus of the five horses were submitted to various powers of the microscope, but that of about 600 diameters gave, generally, the most satisfactory results. Fig. 41 represents the character of the fungi and mucus cells.

Fig. 42.



Some pollen cells were also observed. Each portion of mucus sediment prepared as described, and no larger than the head of the smallest pin, contained twenty to fifty spores of fungi.

My attention was next directed to the detection of the floating germs, if any, in the stable atmosphere of the horses affected. For this purpose I devised the following plan: I first prepared a very limpid varnish, by dissolving one ounce of copal varnish in two pints of benzine, a part of which I poured over a sheet of glass 15 by 15 inches, the superfluous portion being instantly drained off. The varnish dries quickly, yet retains a sufficient degree of adhesiveness to retain dust of any kind which may fall on it. A plate of glass thus prepared was secured over the head of one of the sick horses in the Department stable, where three other horses were confined, all of which were affected with influenza. The glass was placed horizontally, with varnish side up, and about 9 feet from the floor. After the lapse of twenty-four hours it was removed, cut into slides 3 by 1 inch, and examined with gum and glycerine solution. In each case the objects prepared for observation were covered with the usual form of microscopic discs. The objects brought into view in this way, under the microscope, proved to be very similar, generally, to those found in the mucus, only much more numerous.

Fig. 43.

Fig. 42 represents the forms of the spores found in the stable atmosphere.

A second plate of glass 15 by 15 inches, varnished as described, was placed in the center of one of the large grass-plats of the Department grounds and allowed to remain in the open atmosphere twenty-four hours. The plate was then cut into slips 1 by 3 inches and examined by the microscope; but I failed to discover a single fungi spore, or a vegetable germ of any kind. I think it probable that nearly all the fungi spores found in the mucus and stable atmosphere had their origin in the food provided for the horses. The torula cells may have had another source.

Fig. 43 represents the class of forms in the atmosphere of the lawn.

I diluted a portion of diseased mucus with water in the proportion of about two parts water to one of mucus, and set it aside for eight days. On the ninth and subsequent days it gave the infusorial forms and fungi cells. (See Fig. 44.)

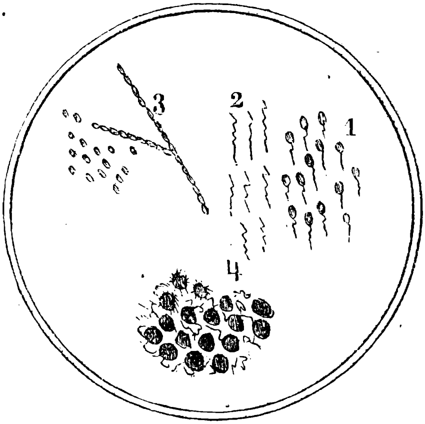
THOMAS TAYLOR, *Microscopist.*

MICROSCOPIC EXAMINATION BY DR. E. E. JACKSON, OF COLUMBIA, SOUTH CAROLINA.

1st. A stabled horse; large quantity of mucus and pus. Examination of discharge showed filaments of fibrine and organized bodies.

2d. Horse passing on street; thin discharge; same organized bodies seen through microscope.

Fig. 44.



3d. Early stage; thin discharge; same organized bodies.

4th. Very thick discharge; much coughing; no organisms apparent.

5th. Thin discharge, early stage, organized bodies in abundance; seven in one field of the instrument.

6th. Mule; thin discharge, numbers of organized bodies, with mucus or pus.

7th. Similar to above, (mule.)

8th. Mule; thin discharge, in one field of view one very large organism; in another six of ordinary size.

9th. Thin discharge from an ox examined; no organisms.

10th. Horse; numerous organisms.

11th. Horse; thick discharge; no organisms.

Fig. 45.

12th. Horse; thin discharge; no organisms; no motion visible.

In all the cases were found vegetable spurs or hairs from grain or rough food. Have seen similar organisms in stagnant pools and in decomposing vegetable matter. Microscope used, 750 magnifying power.

Fig. 45 represents the vegetable spores.

The similarity of the spores seen by Mr. Taylor and myself will be manifest to the reader. In my case they had the same orange-brown color which he has so well depicted. In my observations there was no opportunity for the growth of mycelium, so that the differences in this respect are of no significance. The fact that these germs were more abundant in the hay than in any other medium testifies strongly enough as to their true origin. Then the results of Dr. Jackson's observations, in showing an entirely different organization, would seem to indicate that these are merely different manifestations of vegetable life under varied climatic conditions, and are of no significance in connection with influenza.

And to this effect is the testimony of Dr. J. J. Woodward, of the Medical Department of the Army, who says:

> Within the last few days I have collected the organic forms from a quantity of the air in a stable in this city, in which were a number of sick horses, and submitted them to the highest powers of the microscope, without finding any which are not usually encountered when no epidemic is prevailing, and have also subjected the mucus discharge from the nostrils of several of the horses to the same examination, with like negative results.

The other doctrine is the most reasonable one, and is one which appears to explain all the pathological phenomena. It recognizes in the granules which exist abundantly in the diseased organs the morbid agent capable of transmitting the disease. These granules, which are merely microscopical particles of variable size and form, often possess many of the characters of the ultimate nutrient centers, (nuclei, germinal matter of Beale,) even to the power of rapidly absorbing coloring matter, and which seems to imply a capacity to appropriate other material for the increase and multiplication of their substance. These nuclei or granules are reproduced with extraordinary rapidity in the substance of the diseased mucous membrane and at the expense of the vital elements, liquid and solid, of the body, so that Beale and others have concluded

that they either constituted the virulent principle or contained it. Yet nuclei or granules increased to an extraordinary extent in parenchymatous organs, the seat of simple inflammation. These, of course, cannot be considered as pathogenic. And yet there is no greater reason for assuming a similarity of developmental power in these nuclear products of a simple inflammation, and those of an influenza or rinderpest, than for assuming equal powers of growth in the nuclei of different healthy organs and structures. If nuclei, apparently indistinguishable from each other in all respects except their position, never fail to build up the substance of that particular tissue to which they belong, the nuclei of bone invariably producing bone; those of gristle, gristle; those of fibrous tissue, fibrous tissue; those of muscle, muscle; and those of nervous matter, nervous matter; and if we can ingraft the nuclei of bone and other tissues so as to build up such textures in unusual situations, is there any insuperable objection to the conclusion that one class of such morbid granules are harmless, while another class invariably develop influenza, and that alone; a third class small-pox and that only; a fourth class glanders, and nothing else; a fifth class, rinderpest only; a sixth class the contagious lung-plague of cattle, etc. The physiologist has learned to realize that living particles, which are almost infinitesimal in their minuteness, have characters as constant and a power of development as certain and definite as the genera of animals from which they were derived. There is no valid objection, therefore, to the theory which recognizes in those products of a specific disease the virulent elements by which the affection is perpetuated and transmitted. And this is the theory which appears at the present time to be most in accordance with the history of influenza.

In taking this position, it is sought to deny the conveyance of the disease by atmospheric means. The numerous instances of horses having been attacked in the open fields, apart from all roads, and from other horses, and the rapid diffusion of the disease over a city or district, seem to imply the intervention of atmospheric agency. But our position by no means precludes such an agency. It only assumes that there is a specific virulent element, which finds in the body of a susceptible animal the material essential to its growth, its unlimited reproduction, and extensive diffusion. The air may still be invoked as an important medium through which the dried and drying virus or *bioplasm* (Beale) may be carried to long distances, and infect new animals and localities. It is further in keeping with the theory that the skin and clothing of human beings, and solid objects of nearly every kind, may become the medium through which the disease is conveyed from place to place, and will thus explain many outbreaks which would otherwise appear to be spontaneous.

This theory further explains the outbreak on islands near the shore simultaneously with its appearance on the mainland, and all well-authenticated cases of the infection of the ships' crews at sea. Thus the equine influenza is alleged to have appeared in Block Island, about ten miles at sea, on the same day that it broke out on the Connecticut shore. Were it proved (which, however, has not been attempted) that there had been no recent communication between this island and the shore, there would be nothing in the fact to overthrow the position taken in this paper. A similar case is that of the Stag frigate, recorded by Watson. In 1833 this ship was coming up the English Channel, and when off Beechy Head, in Devonshire, the wind blew strongly from the shore at 2 o'clock, at which time all the men were healthy, (and it is presumed, but not affirmed, that there had been no communication with the shore;)

at half past 2 forty men were suddenly attacked with influenza; at 6 o'clock sixty men were ill, and by the next day one hundred and sixty. The instances of Admiral Kempenfeldt's and Lord Howe's squadrons, attacked while cruising at different parts of the same channel, in 1782, after they had been from twenty-two to twenty-seven days at sea, are no more difficult to explain. Indeed, the fact that a squadron had been technically a number of days at sea is no proof that officers and men had not availed of their near proximity to pay frequent visits to the shore.

Pathology.—Influenza has been thought to be a simple catarrhal disease, with a special prostrating or debilitating tendency, because of some unknown condition of the atmosphere, or something else vaguely referred to as epidemic influenza. Some color was lent to this by the irregular and sometimes dangerous course of the disease occurring during an influenza epizootic. But this influencing of other diseases is common to other epizootics the specific nature of which is unquestionable. During the cholera epidemic, for example, not only men but animals show a special irritability of the digestive organs and tendency to diarrhœa. In marshy regions nearly all other affections are modified in character and course by the malarious poison, and, indeed, the history of influenza is that of a disease propagated by a specific poison, and advancing in the face of all circumstances and obstacles, and entirely independently of those conditions which cause the development of catarrhs.

That a specific poison exists is fairly established by an impartial review of the epizootic of 1872. But this poison does not produce in all cases the same phenomena. The symptoms of nasal catarrh are the most constant, but they are often slight, and, at an early stage of the disease, even overshadowed or superseded by those of intestinal catarrh or rheumatism; and if the poison may thus localize itself in unusual situations without apparent cause, how much more likely if some organ, or system of organs, is already the seat of disease and consequent weakness and susceptibility.

The theory of the existence of a fungus, which multiplied in the atmosphere, or in the diseased body, or in both, has long been a favorite one, and would fully explain the phenomena of the disease and its progress. But no such fungus has been found, and those found in the more northern part of the continent differ from those found in the south. They are moreover found in great abundance in the dust of fodder, and as plentifully after the disease has long passed as during its prevalence. This doctrine is therefore at present in want of facts to sustain it. The only other tenable hypothesis appears to be that of a true contagium. Particles of the living body (granules or bioplasm) are given off in myriads, are carried widely by the air, and infect other animals.

How, then, does such poison operate? Hertwig's experiments seem to show that it is not conveyed from animal to animal by the transfusion of blood, and cannot therefore be present in the circulating fluid. It would follow that the various nervous, rheumatic, and cardiac symptoms were produced by nervous sympathy, owing to the presence of the poison on the mucous membranes, or by the absorption of some noxious products formed in the mucous membrane by reason of its presence. Yet this fails to explain satisfactorily the early and profound prostration before the poison could be developed to any extent on the mucous membrane, the extreme weakness and inability for active exertion which remains after the animal has apparently recovered, and the liability to one or other of the dangerous complications which exhaustion or maltreatment at

such periods is liable to bring on. It will be a matter of sincere regret if the transfusion and inoculation experiments are not put to a crucial test before the epizootic shall have disappeared. At present the question cannot be definitely answered as to whether the poison is received into the blood and acts directly on the different organs, or is confined to the mucous membranes and affects the other parts of the system indirectly.

The state of the blood and of the tissues affected throws little light on this subject. The respiratory mucous membrane, as in simple catarrhal inflammation, is the seat of congestion and blood stasis, with exudation, cloudiness, and softening of the membrane, and an excessive production of granular matter and cells of mucus and pus. But it shows at the same time a great tendency to assume the deeper shades of red, and presents in many cases *petechiæ* as indications of the presence of some potent blood poison, or at least of a highly impure and disorganized condition of the blood. The inflammation of the lungs, too, is manifested rather by that semiliquid infiltration which characterizes the contagious lung fever of cattle than the firm consolidation of a strong type of inflammation. The blood in the early stages contains an excess of fibrine, and coagulates with a large amount of buffy coat, and a cupped surface, as in simple inflammatory affections. Later, however, and especially in the most malignant and fatal case, it becomes diffluent, and comparatively incoagulable, as is seen in cases wherein a potent and destructive poison has been present, and in the advanced stages of deadly fevers, where the blood is in a highly impure and disorganized condition. It is not easy to explain the morbid phenomena without assuming the presence of a poison in the blood, and it is still possible that there was some source of fallacy in the tranfusion experiments; but here the subject must be left in anticipation of further developments.

Treatment.—All debilitating or depressing treatment must be sedulously avoided. Bleeding, purging, severe action on the kidneys, depressing sedatives and violent blistering are alike to be deprecated. In the regular and incomplicated form of the disease, nearly all will recover under good nursing and fresh air, and independently of all medicinal agents. Place the patient in a cool, dry, well-ventilated, and well-littered box; clothe him comfortably, so as to avoid all tendency to chill, bandage his legs loosely, and change the clothes, and curry or brush the skin twice or thrice a day; keep quiet and still, although usually a little exercise in hand, in the shelter and sunshine, will be rather beneficial than otherwise. Feed on bran mashes, boiled oats or barley, turnips, carrots, or other roots, in small quantities, and often, so as not to clog the appetite, and supply at frequent intervals a quart or two of water, nearly cold, or cold oatmeal or linseed gruel.

It is important to favor depuration of the blood by moderate but never excessive action of the kidneys or bowels. Costiveness will oftentimes be best met by abundant and frequent injections of water, blood warm, (three or four quarts at a time,) or by one-half pound of molasses, or three ounces of sulphate of soda added to the drink. If a laxative is absolutely necessary, it should rarely exceed one-third of the ordinary dose, on account of the dangerous susceptibility of the digestive organs. The author has seen a large Percheron die of superpurgation, after taking but three drachms of Cape aloes. During the recent visitation an instance came under his notice in which half a pint of linseed-oil came nigh proving fatal. This susceptibility of the digestive organs, however, varies widely in different epizootics, and in some mild laxatives

proves highly beneficial, yet their possible danger should always be present to the mind.

Mild febrifuge diuretics may be used with advantage. Spirits of nitrous ether, in half-ounce doses, may be given twice a day, or liquor of the acetate of ammonia, in ounce doses, four times a day in the water gruel drank. If the fever runs high, or effusions threaten to take place, these may be increased as far as the strength will allow, but always with the greatest caution and judgment.

When the cough proves especially violent and painful, the addition of anodynes, such as belladonna and camphor, is advisable. A drachm of each may be added to the diuretics already advised.

The cough may be further relieved, and the relaxation of the mucous membranes and the appearance of the discharge hastened, by causing the animal to inhale warm water vapor several times a day, for an hour at a time. This is most conveniently done by saturating chaff bran or other simple agent with boiling water, placing it in a nose-bag, which is then hung on the patient's nose by means of a strap crossing behind the ears. This proves especially beneficial, as the moderation of the fever is usually a concomitant of the appearance of the discharge. Burning a pinch of flowers of sulphur, more or less, according to the size and nature of the building, so as to impregnate the air to an extent just short of causing irritation and coughing, has a very soothing and beneficial effect on the mucous membrane. It is best done by laying a piece of paper bearing the sulphur on a shovel, and setting fire to it. It is superfluous, perhaps, to say that it must be done behind the patient, and not beneath his nose. The fumes of vinegar from a red-hot brick, of burning leather, and the like, are cruelly irritating, and occasionally induce fatal results.

Counter-irritants are often useful from the first. If, however, inflammation and sore throat seem extreme, a poultice may be advantageously applied for a day previously, or the throat may be well fomented with warm water for an hour and then wrapped in a sheep-skin with the wool turned inward. When, however, there appears little danger of even temporarily aggravating the local inflammation, the throat or chest, where the disease has been localized, it may be well rubbed with a thin pulp made of the best ground mustard and tepid water, and then covered up. This may be replaced by the soap liniment, made with six ounces of soap, three of camphor, and a pint, each, of proof-spirit liquor, ammonia, and linseed oil. This liniment may be applied repeatedly at short intervals and well rubbed in. If a more active blister is wanted an ointment may be used composed of a drachm and a half of powdered cantharides, a scruple of camphor, ten drops of spirits of wine, and an ounce of lard. The hair should be cut off and the ointment well rubbed in, in a direction contrary to that of the hair. After it has acted, the skin should be kept soft and pliant by rubbing it with fresh lard. Oil of turpentine, which has been largely used as a counter irritant during the present epizootic, is only objectionable on the ground of its causing so much local irritation without blistering as to drive some excitable horses to distraction.

In using any one of these counter-irritants it is best to apply them over a limited space only, not exceeding the bounds of the inflammatory action, as we can thus secure the best results from the intimate nervous sympathy existing between the deeper-seated organ and the skin which covers the corresponding part of the surface, and at the same time avoid the depressing and debilitating effects of a blister. For

this reason a careful examination, of the chest especially, should always be made before making such an application.

As the mouth becomes cooler and more moist, and the pulse softer and less frequent, a more stimulating treatment is desirable. At first two drachms each of gentian, powdered cinchona, niter and sal ammoniac, may be given night and morning, or if the debility is very great the last-named agent may be replaced by four drachms of carbonate of ammonia made into a bolus, with linseed meal, or dissolved in a half pint of water, and repeated three or four times a day. In cases marked by a daily remission, I have found a dose of 30 grains of sulphate of quinia to prove effectual in preventing the paroxysm, if given an hour or two before the period when it was in the habit of appearing.

During convalescence gentian, cinchona, and other tonics, are desirable, with alcoholic, ammoniacal, or other stimulants, if there is much debility or prostration. The diet should be tempting and nutritious, supplied often, fresh and frequently varied, and care should be taken at all times to counteract any sudden suppression of the secretions of the bowels or kidneys, or even the nasal discharge. In this connection I may mention the statement of Mr. Murray, of Detroit, that all the cases of dropsy that came under his notice occurred in animals which had taken for a few days "condition powders," consisting largely of sulphate of iron, and had had the nasal discharge suddenly dried up. Improvement followed promptly on the withholding of the powders and soliciting the action of the kidneys and bowels.

Should the prostration become extreme, stimulants must be resorted to even more frequently than is recommended above; five, or even six times a day. In some instances, however, the system seems to lose all power of reaction, and almost the only remaining hope lies in the transfusion of blood from the veins of a healthy animal to those of the sick. The blood may be obtained from a healthy horse, or more conveniently from oxen or sheep intended for slaughter. It may be transferred through an elastic tube without exposure to the air, or it may be drawn off into a vessel and thence transferred to the veins of the sick horse, unchanged or defibrinated.

The first-named mode, which was practiced by the late Mr. Farral, of Dublin, is in many respects the most convenient. The operator must furnish himself with a caoutchouc tube about a yard and a half long, and with a silver tube four inches long, and a third of an inch in diameter, fitted into each end. The jugular veins of the two animals are now opened with fleam or lancet, the pressure being maintained below the orifice so as to obviate the entrance of air into the vein and to facilitate the introduction of the tube. The tube having been filled with tepid water, is now inserted from below upward toward the head into the jugular of the sound animal, and from above downward, toward the chest into the jugular of the sick. The middle of the tube is passed through a vessel containing water at the temperature of the animal body. The tube, hitherto compressed between the finger and thumb, is now relaxed and the blood is allowed to flow slowly into the system of the patient. Any indication of nausea or vertigo, turning up of the upper lip, jerking upward of the head, or unsteadiness of the limbs, is to be accepted as a warning, and the current of blood must be stopped or reduced until the animal has rallied. After a sufficient amount appears to have been transferred, the tube is withdrawn and the wounds pinned up as after ordinary bleeding. About three quarts will usually be borne, and the results will be seen in increased firmness and fullness of the pulse, and a more healthy hue of the mucous membranes.

In the second mode there is introduced into the vein of the patient a tube, which is dilated at its free end into a funnel about an inch in diameter, and furnished with a wooden plug accurately fitted to the bore of the tube. A little blood having been withdrawn from the sound animal into a dish standing in water of the temperature of the body, and the funnel having been quickly filled, the plug is pulled out and the blood allowed to flow in. Before the funnel is quite empty, the plug is again inserted, the funnel refilled, and the process repeated. In this way all danger of the introduction of air is obviated.

The third mode differs from the second only in the removal of the fibrine from the blood. The blood having been received into a vessel set in another containing warm water, is whipped with a bunch of twigs until all the fibrine has been coagulated and withdrawn, after which the liquid is transferred into the vein of the sick animal with the same precautions as by the second mode. The loss of the fibrine is of no moment, and the defibrinated blood is found to be equally restorative with the pure blood.

The main dangers to be guarded against are the entrance of air into the circulation, the introduction of clots of fibrine, which by blocking the vessels would produce local inflammation and abscess, and the too rapid transfusion which leads to vertigo and fatal fainting.

If the abdominal organs are especially involved the counter-irritant is to be applied over the region of the liver, bowels, or kidneys, as the case may demand. With yellow or brownish appearance of the mucous membranes and tenderness over the short ribs, this point should be selected for its application. With general tenderness of the abdomen, colicky pains, frequent straining, and the passage of a white, thick mucus forming a pellicle over the dung, or collected in masses, it should be applied generally to the surface of the belly. If there is tenderness and swelling of the loins, stiffness of the hind limbs, frequent straining, the passage of water in small quantities and highly colored, and above all if the urine contains microscopic fibrinous casts, it should be applied over the loins. In the last case it may be preceded by a bag of hot scalded bran, or a fresh sheep-skin with the fleshy side turned in.

The shivering, which usually attends the onset of such complications, may be counteracted by friction to the skin, clothing, a warm drink containing a stimulant—four drachms carbonate of ammonia—and injections of warm water or well-boiled gruel, given to the extent of three or four quarts at a time, and repeated every hour until shivering ceases.

In cases affecting the liver or bowels, I have found excellent results from guarded laxatives. Two, three, or even four drachms of aloes in different cases, with a drachm of gentian, and thirty drops of hydrocyanic acid, or an ounce of laudanum, will usually promptly relieve the colic, secure an action of the bowels, and remove the deadly prostration which characterizes this type. It has manifestly the effect of relieving the inflamed surface by a free secretion from its turgid blood-vessels, of benefiting the portal system and liver by a direct local depletion, and of eliminating poisonous material, which was being pent up to the great injury of the system at large. Little more is wanted than the free use of demulcents, such as slippery elm, well-boiled linseed, and the like, great care to secure a continuous moderate action of the bowels, and a tonic treatment as in other cases of convalescence. Turpentine has been strongly recommended by some, and acts beneficially as a local and general stimulant. An ounce of the crude drug, or half an ounce of the oil, may be made into a ball with linseed meal, or beaten up with the yolks of two eggs, and given twice daily.

The affection of the kidneys may demand gentle laxatives, (oleaginous,) anodynes, (laudanum) emollient injections, counter-irritants, stimulants, and later gentle diuretics.

The nervous symptoms will sometimes demand the application of cold wet cloths to the head, counter-irritants to the sides of the neck and limbs, the guarded use of laxatives and diuretics, with drachm doses of bromide of potassium, and if there is great depression, ammoniacal stimulants.

The rheumatic complication is to be met like ordinary rheumatism. Liquor of the acetate of ammonia two ounces, and colchicum wine one ounce, may be given twice a day, diluted in water; tonics, warm clothing, the frequent application of a hot smoothing iron over the affected part of the body, with the intervention of a thin cover, and even counter-irritants are among the agents especially demanded. When the heart is implicated in rheumatic cases the same treatment is necessary, but the blisters are to be applied behind the left elbow.

When there is reason to suspect the existence of clots in the heart, alkaline remedies are recommended, particularly the preparations of ammonia and iodide of potassium, attention being meanwhile given to support the system by tonics and stimulants, and to encourage the elimination of deleterious products from the blood.

If dropsical manifestations appear they must be treated according to their apparent causes; if disordered function of the heart or kidneys, these must be met by appropriate measures; and if from weakness of the circulation, an anæmic or debilitated state of the blood and imperfect nutrition, gentle action of the eliminating organs, with stimulants, tonics, a nourishing diet, (embracing in some cases strong beef soup or tea,) or even transfusion of blood, will be necessary.

Purpura hæmorrhagica is to be met by similar supporting and eliminating treatment, with the addition of oil of turpentine in half ounce doses, or pure carbolic acid in drachm doses, and cinchona in half ounce doses, repeated thrice a day. The skin over the engorgements should be rubbed frequently with a solution of carbolic acid, containing one part of the acid to every hundred of water, and a similar lotion should be applied frequently to the sores when these form.

In short the various complications and sequilæ of simple influenza are to be treated like similar lesions occurring independently of this affection, but with due regard to the great debility attending this disease. The great majority of cases will recover without any treatment; and indeed many require no medical treatment, but a certain number will demand the greatest care of the educated medical attendant.

Prevention.—Many have attempted to ward off the disease by the use of tobacco, camphor, vinegar, tar, asafœtida, &c., and others more rationally by bromo-chloralum, carbolic acid, permanganate of potash, sulphurous acid, and the hyposulphites, but in no case with permanent success.

With a *contagium* like that at present under consideration, so easily diffused through the atmosphere, absolute prevention will always be difficult, though not necessarily impossible. With a disease, too, the tendency of which is almost invariably to a favorable termination, it is scarcely politic to shut up an animal for a month in a disinfected atmosphere, until the disease has subsided, with the probability before us that he would still contract the disease from the remnants of the poison when exposed at the end of this period. Thorough cleanliness and disinfectants are to be highly commended, not with the view of absolutely preventing the disease, but rather with intent to retard and moderate it.

The comparatively non-volatile disinfectants, such as permanganate of potash, chloride of lime, bromo-chloralum, and carbolic acid, may be used for the solid structures of the stable, drains, manure, and the like, while sulphurous acid is above all to be commended for disinfection of the air. This agent, when used frequently and in small amount, so as to be non-irritating, has the double advantage of soothing and giving tone to the diseased mucous membrane, and of destroying organic germs, including perhaps the morbific elements in the respiratory organs.

DR. CALDWELL'S ANALYSIS OF THE URINE.

The following analysis, conducted by my colleague, Dr. Caldwell, is that of the urine of a horse in the last stages of influenza, and which proved on post-mortem examination to have a large clot occupying the right ventricle and firmly attached to the lower surface of the tricuspid valve.

The characters are those of highly febrile urine. The acidity no doubt results from the fact that the animal had been able to assimilate nothing for some days, but was consuming his own tissues to sustain the vital functions. The density, 1.08, is double that of the healthy horse's urine, 1.04. The urea, 4.81 per cent. is at least four times the amount found by Von Bibra in healthy equine urine, 0.83 to 1.24, and nearly double that found by Dr. Marcet in a case of rinderpest in a cow, 2.472. The extraordinary waste of tissue necessary to produce this amount goes far to explain the extreme weakness which characterizes the disease. This was an extreme case, it is true, yet the instance mentioned in the report of two non-fatal cases having lost each 7½ pounds daily, is another illustration of this general tendency of the disease. The presence of albumen is but of secondary significance, as it is a constant constituent of urine in pneumonia, bronchitis, and other inflammatory affections.

The liquid had a sizy consistency, as is commonly the case in albuminous equine urine, and poured like a dense oil from one vessel into another. I found no specimen of influenza urine from which albumen was entirely absent, though often only present in traces, and in one instance a sick mare, on the day before she died, passed it as a solid mass like a thin jelly and streaked with blood.

CHEMICAL LABORATORY, *Cornell University, December* 24, 1872.

DEAR SIR: The following are the results of the chemical examination of the sample of horse-urine that you left with me:

Re-action	Acid.
Specific gravity	1.08
Albumen, per cent	0.35
Urea, per cent	4.81
Total dry substance, per cent	8.5
Ash, per cent	1.04
Phosphoric acid, per cent	0.13

METHOD OF ANALYSIS.

Albumen.—This was precipitated by digestion of a weighed quantity of the urine at 100° C., and the addition of a drop or two of acetic acid; the precipitate was collected on a dried and weighed filter, washed with hot water, dried at 100° C., and weighed.

Urea.—The albumen was precipitated from a weighed quantity of the urine, the filtrate made up to 500cc to 50cc of this liquid, 25cc of a mixture of saturated solutions of baric nitrate and hydrate added, and the urea was estimated in the filtrate from the precipitate by these re-agents, according to Liebig's volumetric method, with a stan-

dard solution of mercuric nitrate. As only traces of chlorine were present, no estimation of it was made, and no correction of the results of the determination of the urea was necessary except for the dilution of the solution.

Total dry substance.—This was estimated by keeping a weighed quantity of the urine at 100° C. in a tube, while a current of washed and dried air was passed over it, and afterward through a measured quantity of standard acid, in order to absorb the ammonia. This operation was continued as long as there was any loss of weight on the part of the residue in the tube; the amount of ammonia absorbed by the acid was then estimated by the usual tituration, and the weight of the same, calculated as carbonate, was added to the weight of the residue in the tube. The amount of ammonia was, however, very small.

The ash.—A weighed quantity of the urine was carefully charred, the coal was exhausted with distilled water, the aqueous extract filtered out, the coaly insoluble residue burned at a red heat, its ash added to the aqueous extract, the whole evaporated to dryness, and the residue gently ignited.

Phosphoric acid.—This was estimated in a portion of the filtrate from the albumen that was prepared for the determination of the urea, by the volumetric process, with a standard solution of uranic acetate.

No sugar could be detected in the urine, by digestion with Fehling's solution.

Yours, respectfully,

G. C. CALDWELL,
Professor of Agricultural Chemistry.

Professor LAW.

FISH CULTURE.

By SETH GREEN, *Rochester, New York.*

BROOK TROUT CULTURE.*

In this paper we shall speak briefly of improvements made during the past year, of the increase and present aspects of the business, and give some hints for general information.

No very great or startling discoveries have been made lately in the science of fish culture. Still there has been a steady advance in the practice of the art. New methods have been discovered of applying known facts; economy of time and labor have been well considered, and much has been done toward lifting the science from the region of experiment into that of a paying business. The discovery most talked about has been that of the so-called dry impregnation, said to have been discovered by a Russian gentleman, and brought to the knowledge of pisciculturists in this country by Mr. George Shepard Page, of New York. The story of the discovery is as follows: The Russian gentleman having attempted many times to impregnate his eggs in the usual way known to Russian gentlemen, failed in that way to impregnate more than a very small percentage. Having made numerous experiments with a view to a better result, he arrived substantially at the following conclusions:

First. That immediately upon its exudation into water, the egg being then in a flabby state, commenced to absorb water, and with it milt, if present; and that the egg retains its power of absorption of the water and milt (and consequent impregnation) for a period of about fifteen to twenty-five minutes after exudation from the fish, the tendency toward

*The section on trout culture is written in conjunction with A. S. Collins, my former partner and successor at Caledonia, New York.

impregnation being strongest when the egg is first exposed, and weakest toward the end of the period.

Second. The milt appeared to be composed of microscopic animal forms, inclosed or swimming in a whitish fluid. If this fluid was retained in the form in which it issued from the fish, the appearance of life was continued for a considerable period; but if the milt was diluted with water all signs of life were destroyed in a very brief time. If, then, both the egg and the milt could be kept from contact with the water until they were mixed together, he thought the chances of impregnation would be very much increased. Accordingly, having taken his eggs first on a dry plate, he mixed with them the milt, and found that nearly all his eggs were impregnated. And this process, or one very nearly resembling it, has been used with great success by the fish breeders of this country.

Now, a few words about this discovery. In the first place there can be in practice no such thing as dry impregnation; because more or less water will always fall from the fish into the pan or plate, and it is hardly practicable to wipe each fish dry with a towel before squeezing. Second, a quantity of eggs, which will cover the bottom of a pan will absord no more water from a pan full of water than from a pan only one-half, or one-quarter, or one-twentieth full. Third, the milt will die just as soon in a little water as in much, and, therefore, be no more effective. Fourth, the advantage which is gained is simply this: That by using little water the animal forms are less widely distributed, and, therefore, the chance of contact with the eggs is increased. Fifth, if the impregnation could be made "dry"—that is, without water—it is only reasonable to suppose that the egg in the absence of water must imbibe air, and whether this would be conducive to the future well being of the fish remains to be seen. It is now generally supposed that the egg absorbs water and not air or oxygen from the water. Sixth, the tendency from the commencement has been in our establishment to use less and less water every year for the purpose of impregnation. Starting in the first years of experiment with a pan full, the quantity has been gradually decreased, until now barely sufficient is used to cover the eggs. The difference in impregnation in skillful hands between one-quarter inch and one and one-half inches of water may amount to 5 per cent. In unskillful hands it will amount to very much more. Our advice is, to use only enough water to fairly cover the eggs, and until further experiments are made not to use less.

Natural impregnation.—Some years since it was thought that a universal panacea for all the ills of trout-breeders had been found in the discovery of a means of *natural* impregnation. The first invention was made by Mr. Stephen H. Ainsworth, a name well known to and honored by all fish-breeders. His invention was followed by others, using the same principle, but economizing time and labor to such an extent that if the naturally-impregnated eggs had really been any better than those artificially impregnated, the system would have been perfect. Even now there is great diversity of opinion among trout-breeders, some persons not being willing to use any but naturally-impregnated eggs, and others making no use of them whatever. We ourselves prefer the eggs artificially impregnated, for several reasons. One reason is that many more eggs can be impregnated in this way than by the natural process. If any one will take the trouble to dig up the eggs laid by wild trout in a natural stream he will find that but a very small proportion bear marks of impregnation, the percentage varying from 3 to 10 per cent. The races put down on the Ainsworth plan do much better than this, the

proportion of eggs impregnated being perhaps 75 or 80 per cent. Then, also, the eggs taken from the Ainsworth screens are mixed with sediment and fibers of woody matter, saturated with water, which are a source of great annoyance; and beside this, in order to get all the eggs from a pond full of trout on the natural plan, the area of screens should be three or four times as great as the usual area of race employed for stripping purposes. Now, the chief claim of those who urge the use of naturally-impregnated eggs is, that they grow into better, stronger, more hardy, and more healthy fish than the other. If this was the case the difference of percentage in impregnation, &c., &c., would not be worthy of consideration. But after some years of experiment it looks to us as if the advantage, if any, was rather on the side of the artificially-taken eggs. Why this should be so is a mystery, as, theoretically, naturally-impregnated eggs should be perfect. We recommend methods of natural impregnation only to beginners in the art, or for use in places where it is not convenient to take the fish at proper seasons. For instance, the owner of a trout-stream may wish to collect trout-eggs during the season, but may not have leisure to attend to it more than once a week, or may not be able to obtain the necessary assistance. In such a case one of the Ainsworth races fixed at or near the head of the stream would collect the eggs, and keep them in good order for a week or more at a time.

Transportation of eggs.—Great improvements have been made in the transportation of eggs. The method is the same which Mr. Green used long ago. Eggs to be packed in tin boxes about three inches by two and one-half, holding one thousand each, for convenience in counting, unpacking, and arranging. Moss to be used for packing material as being on the whole the most reliable. Only the softest moss is used, cut into half-inch fibers, and well washed before packing. Saw-dust to be used (for packing the tin boxes) in larger or smaller quantities according to the distance to which the eggs are to be sent, and the temperature to which they are to be exposed. Greater care is now used in packing the eggs in the moss, and for long journeys the tins are surrounded by a double wall of saw-dust or straw. Thus packed, the eggs stand everything but great extremes of temperature or handling. But the greatest improvement made in transportation is in the fact of not sending the eggs until they are within three or four weeks of hatching. The older the egg the more rough usage it will bear with impunity. Eggs sent within four weeks of hatching generally arrive in good order, unless the temperature has been unexpectedly high or low, or they have been subjected to violent blows by careless handling.

Hatching eggs.—In regard to the apparatus in which eggs should be put to hatch, opinions are still at variance. Some fish-breeders prefer the Costé trays; some use the stone-charcoal trough, and some hatch on slate beds; while we still give the preference to the old gravel troughs as being on the whole the handiest, least expensive, and best. Perhaps it may be of service to give the test we used in experimenting with the different sorts of hatching arrangements. It is well known that an egg not impregnated will not die at once if placed with the others, but will last a longer or shorter time; sometimes remaining of a natural color until after the impregnated eggs of the same age have turned into fish. Now the test of the value of any hatching arrangement is the length of time in which unimpregnated eggs will remain of a natural color. If they will remain apparently good until after the impregnated eggs with them of the same age are hatched out, then the arrangement is about as near perfect as it can be. It has been insisted that the earliest hatched

eggs were best, and also that eggs hatched in a temperature of 40° to 45° made the hardiest fish. Our experiments thus far seem to indicate that there is no difference, fish from eggs spawned in March doing as well as those from eggs spawned in October, and eggs hatched in 50° doing as well as those hatched in 35°.

Growing young trout.—This has always been the rock upon which new beginners have been shipwrecked. Very few persons have found any special difficulty in hatching out the eggs or in keeping the young fish until the sac was entirely absorbed. But a very general want of success has been felt in rearing the brook-trout from the age of forty-five days to the age of three or four months. There must be some reason for this; let us see if we cannot find it. The failure must lie in one or more of four circumstances. Either the eggs are not good in the first place, that is, imperfectly developed, or for some reason producing weakly fish, or the water in which the experiment is tried is not adapted to the young fish, or the food which is commonly used is not the proper food, or the fault lies in the person feeding them. Now, does the fault lie in the eggs? We have no doubt that fish sometimes, from a lack of vitality, &c., produce imperfect eggs, and we have just as little doubt that the greater part of such eggs die before they are many weeks old. A few may survive the hatching process and absorption of the sac, but their number is exceedingly small. Our reasons for this belief are as follows: First, we have often taken the eggs from fish evidently diseased, and kept them in a place separate from others. In nine cases out of ten it was impossible to impregnate these eggs at all, and of those which were impregnated not one-tenth would live until the fish became plainly visible to the naked eye, and a still less proportion would survive until the sac was absorbed. Then, again, if the failure to raise the young fish lie in the imperfection of the egg, we should expect in every case that some at least of the fish should be vigorous and healthy, as it is hardly possible that all the eggs should be imperfect. Whereas it is the general complaint of those who fail, that all their fish die together, and that they can raise none of them; and, still further, of two persons receiving eggs from the same batch, one will raise a good percentage and the other will raise none. Therefore it would seem to us that the fault does not lie in the egg or in any manipulation thereof. Neither can it be in any large number of cases that the water is unfit for them, because they have been raised by different persons in water at varying degrees of temperature and impregnated more variously with minerals or salts; and still less can this be true, because successes and failures have been made in different seasons by the same person in the same waters. Neither do we believe that the failure lies in the matter of food, as they have been raised successfully on curd alone, on liver alone, on beef-heart alone, on beefsteak alone, on liver and curds, on heart and curds, on liver and sweet cream, and on all together. It therefore looks reasonable to suppose that the failures must be looked for in the person feeding them. And this supposition is strengthened by the fact that some persons never fail to raise a crop and others always fail. Let us look at the facts in the case, and see what common sense will teach.

Suppose that a man has eggs enough to hatch out ten thousand trout. During the period of sac absorption, if he attends to the flow of water and does not raise it too fast, he will lose but few. When the sac is nearly absorbed, and the trout begin to come to the surface, they must be fed. Now the question is what substance to feed. Suppose our friend thinks, according to prevailing opinion, that curd does not con-

tain nutriment enough, and determines to feed upon heart or liver or beef. In order to get this fine enough he chops it up with an old razor or with a chopping-machine or cleaver, and feeds it to the trout. That is, he throws it into the water for them to eat if they are willing, or if they can. We can see the trout eating greedily, and we also see falling upon the bottom a large proportion of the food which it appears the trout reject. Let us take a little of the preparation he is feeding and examine it. In most cases we shall find that it is composed of a few very fine particles mixed with a number of larger in the proportion of about one particle of the fine to ten coarse. As young animals of all kinds eat more in proportion to their size than older ones, we should expect the young trout to eat voraciously. One hundred mouthfuls per day for each one would not be perhaps too large an estimate. These mouthfuls must be no larger than the size which a little trout can conveniently seize and swallow, (for very young trout less than the one-thirty-second of an inch in diameter,) as trout do not bite their food, but swallow it whole. Then, in order to give these ten thousand fish one hundred mouthfuls each per day, a quantity of liver must be divided into one million particles, each one-thirty-second of an inch or less in diameter, and all the larger pieces left in are not only a total loss, but so much positive damage, as they tend to foul the water. That the reason of failure lies in a lack of properly-divided food, we should also judge from a comparison of the results of feeding other fish. The (true) salmon, salmon-trout, white-fish, and herring belong to the same family of fish as the brook-trout, and the methods of hatching, feeding, &c., are similar. Of these the salmon makes the largest fish when the sac is absorbed, and is the least difficult to raise. The salmon-trout is next in size, being generally twice as large as the young trout, and 95 per cent. is not an unusual average to raise. On the other hand the white-fish and herring make very much smaller fry than the brook-trout, and we have never succeeded in raising any of them by artificial feeding, and have never heard of any one who has succeeded. In all our experience we have found that he who has had the patience and skill thoroughly to feed his trout has always raised them, and all others have failed. This extreme care and delicacy in feeding is only required during a few weeks, as the larger the trout grow the less finely divided do they require their food. But it is just in those few weeks that the failures occur. Nor should the feeding be intermittent, as a day or two of starvation will not add to the general health of the stock. Men succeed better with small farms than with large farms, with a few trout than with many trout, and the reasons are obvious.

In regard to the *kind* of food our opinion remains unchanged, that any animal substance which can be finely enough divided is good for food for the young, and that probably a variety is better than feeding on one thing alone.

Filters.—All the water which entered the hatching-house used to be passed through a large filter. The plan now generally adopted is not to filter the water at the entrance, but as it passes out of the supply-trough into the hatching-troughs. This is accomplished by means of one or more flannel screens laid under the spigot which supplies the trough. The advantage of this arrangement is that it is necessary only to filter the water used for hatching, and not to clean two or three inches of water for the sake of using one quarter inch. Besides this the small screens are more easily cleaned, none of the dirt is spilled in removing them, and enough of them can be used to thoroughly clean the water.

A little sediment is also not minded so much as formerly; and there

has come into use a watering-pot with fine rose-jet for the purpose of sprinkling and thus cleaning the eggs when sediment has been deposited upon them. The introduction of the watering-pot into the hatching-house is due to Mr. Samuel Wilmot, superintendent of the Canadian government hatching-establishment. It is most effective, however, when the eggs are hatched out on trays. As the method of hatching on trays is not generally known, and is not, we believe, mentioned in accessible books, it will be briefly described here, as used in the New York State hatching-house, at Caledonia. The troughs are made fourteen inches wide (inside) and six inches deep. Iron-wire cloth, of ten or twelve meshes to the inch, is stretched tightly upon wooden frames, whose sides are one inch wide by one-half inch deep, the screen being a little less than fourteen inches wide, in order to fit easily into the trough, and about two feet long. One-quarter inch strips are also nailed under the two long sides. The water is raised nearly to the top of the trough, and four or five of these wire trays filled with eggs can be placed on top of one another. No filter is used, as more water is required than in the usual plan, but as soon as sediment settles on the eggs, an empty trough is cleaned and the trays of eggs are taken out one by one, sprinkled with the watering-pot, and set over, bright and clean, into the clean trough. The trough thus made empty is cleaned and filled from the next, &c. The only advantage of this plan is that it economizes room and enables the eggs to be more easily looked over. But for all purposes of accurate hatching, the old gravel-beds are preferred.

Experiments to be made.—Accurate experiments should be made by those having means and leisure in the following directions:

As to weight of food given and increase in weight of fish in one year.

As to kind of food which will give best results.

As to their relative increase in weight at different periods of their lives.

As to the average age of a trout and average period of maturity.

As to the best age for spawning purposes, &c.

Some eight years ago, we believe, Seth Green's was the only establishment in the United States making a business of raising and selling fish-stock. Now there are about a dozen widely-known farms, and some hundreds of smaller ones which have attained only a local reputation. Of these establishments, Pennsylvania has the most in number, although not the largest, Massachusetts is probably next, while New York boasts the largest and most complete. A remarkable fact is the increase of trout-breeding in the more western States. Ponds, &c., for this purpose are now to be found in Ohio, Wisconsin, Michigan, Illinois, Indiana, Kentucky, Tennessee, Minnesota, and California. In fact, there is scarcely a State in the Union into which of late years we have not sent trout fry or eggs. This increase of those practicing the art shows that the practice must be successful to a degree wonderful for an art so new. Trout-culture has now been in use for a number of years, and though there is still very much to learn, yet great and successful progress has been made.

A few words may be in place as to the present aspect of trout-farming as a business. There are now, so far as a matter of this kind can be ascertained, a great many paying establishments. At any rate, many have gone into the business and still remain in the business, which they would not be likely to do unless they found it profitable. Their income is derived from the sale of eggs, live fish for stock, and dead fish for market. There has been such a demand for eggs and stock that it has hitherto almost monopolized the attention of trout-breeders; and, as it is the

most profitable and least laborious part of the work, although requiring the most skill, all new establishments strive to make it a specialty.

There has been no diminution of the demand hitherto, and during the last ten years every year but one has shown a marked increase in the business. There are also good reasons why the business should continue to increase. Densely-settled countries have a tendency to economize food-production. When our country was sparsely settled, fish were in such abundance that they had very little or no market value. As the population increases, the supply of food, not increasing in the ratio of the population, rises in value, and must do so as long as the population increases. Our country has very many barren trout-streams which are to be stocked; and, to do this effectively, will require many more in the business than those now engaged in it. Then, again, these streams must not only be stocked, but must be kept stocked. If a large number are taken out every year for market, their place must be supplied by young, or the supply will inevitably fail. Of course, the extent of the business in the future must be a matter of conjecture. But it seems now to be established on as firm a basis and to have as good prospects of increasing demand as any other.

It is an encouraging fact that there is now a greater diffusion of trout-knowledge among the community at large. Ten years ago people had a mere general idea of how the thing was done, and the knowledge was not easily to be obtained. Now, however, books giving all known details can be readily found.

As we have very many inquiries as to books on the subject, it will be of service to give the names of prominent works: Domesticated Trout, by Livingston Stone, published by J. R. Osgood & Co., Boston, Massachusetts; Practical Trout-Culture, by Dr. J. H. Slack, published by Orange Judd & Co., New York; American Fish-Culture, by Thaddeus Norris, published by Porter & Coates, Philadelphia, Pennsylvania; Trout-Culture, by Seth Green, published by Seth Green & A. S. Collins, Caledonia, New York. Most prominent pisciculturists keep these books for sale. Valuable articles on fish-culture may also be found in the various sporting-books of Hon. Robert B. Roosevelt, published by Harpers and Carleton, of New York, and in the book on Fishing in American Waters, by Genio C. Scott, also published by the Harpers. The works of Garlick and Fry, although the oldest, and valuable as contributions to the history of fish-culture, are not now of practical value.

Beside the issue of numerous works another help has been the eagerness with which newspapers have published articles relating to fish-culture. It is true that some very absurd statements have found place in their columns, and that stories about fish-ponds have not grown any less by being repeated. But, on the whole, much valuable information has been diffused, and public attention aroused and excited. Then, too, people now engage in it who mean to make it a business. At first those who raised fish did it from curiosity, or as a pastime, or for the purpose of scientific investigation. But now they go into it to make money, and doing this are willing to learn before commencing. The conviction has gradually been forced upon all, that fish-culture required at least as much knowledge and experience as farming or any of the mechanic arts. A man's knowledge of fish-raising must be paid for in some way. He must either get it from some competent person, and pay him for imparting the knowledge, or he will pay for it in the losses caused by his inexperience. Even when all theoretical knowledge is obtained, experience is still required to make things work easily; and it is an encouraging sign that people are ready to acknowledge this and willing

to learn from those who have already been through the mill. Then, again, capitalists now seem to be willing to engage in the business, and although, as in farming, a great deal can be done with very little money, yet a great deal more can be done by the use of a little capital.

Again, those who start in the business now have the results of all their predecessors' failures and successes before them, and if they make the same mistakes they have no one but themselves to blame. As more is now known about the business, they start under better auspices and with a better chance to economize in labor, construction, and maintenance. All these points are highly encouraging, and would seem to indicate that the next ten years will show no retrogression, but a steady advance in the art.

A few hints to those making it a business may not be out of place here. In selecting a site for fish-ponds be very sure that the supply of water is unfailing. The strength of a chain is always measured by the strength of its weakest link. If a spring should give twenty inches of water most of the time, but only one inch in a very dry season, then the flow of that spring is only one inch. It has more than once happened that a would-be fish-breeder has found his ponds without water, and his beautiful spring dried up. Then, too, it would be exceedingly convenient, though not absolutely necessary, to have such a fall that every pond could be drained, and the pond should be so situated that a rising and overflow of the stream should not overflow the ponds. This cannot be arranged very well if the ponds are made, as has been often recommended, by dams in the stream itself. They should be made at one side of the stream, taking all the water if required, but leaving the bed of the stream itself as a convenient waste-gate in case of overflow. One dam across the stream will turn the water into the ponds, and the flow can be made even.

The distance of a spring from a market makes but little difference in these days of railroads and refrigerator-cars. But the amount of water and shape of land make much difference. It is also well to own the spring itself, if possible, in order to prevent disputes with other owners, and to have the water always pure.

Ponds for fattening purposes are now generally made small—say about twelve feet wide by twenty-four feet long, either in the shape of a square or of an oval. It is a matter of fact that trout will find more natural food in a large pond than in a small pond. A large pond has also several other advantages over a small pond. For instance, it is more economical to build one large pond than two small ones, and it is less trouble to take care of one race-way and one set of screens than of two. But the fatal defect in large ponds is that the fish cannot be equally fed. The larger and more voracious will follow the feeder as he moves around the pond, and drive away the smaller and weaker fish. But in a small pond the food can be thrown all over the surface at once, and all the fish have an equal chance.

The materials of which ponds should be constructed vary with the nature of the soil. In heavy clay ground embankments alone are necessary. But in fact so much trouble has been caused by muskrats perforating embankments and liberating the water, that we are tempted to say that embankments alone should never be used. In most soil either stone or wood should be used in construction. If stone is used it should by all means be cemented and the bottom of the pond finished in grout, or large flat stones, with the interstices filled with cement. In order to clean out the lime, water should be run through the pond some weeks before putting in fish. The cement and stone will crack and in

time become defaced at the water-line. This may be remedied by a facing of board along the surface-line. We have lately constructed very good and cheap ponds of rough hemlock boards, (our cheapest lumber,) and find that they answer exceedingly well. Thirty feet long, four feet wide, and six inches of water will do very well for race-ways to small ponds.

The supply of water necessary to raise trout for market purposes (making it a business) should not be less than thirty or forty inches, and would be better if larger. Adults should be fed regularly once each day. The only rule to be given as to quantity is to feed them till they will eat no more. It is economy to cut the feed finely and feed slowly, as most of that which is not eaten at once will be wasted. A little water should be mixed with the meat, and wetting the knife or cleaver often makes easier chopping, and causes the food to spread evenly when thrown into the pond. Cut the toughest food for the largest fish. Keep your pans, chopping-block, and meat-house clean, and feed your meat before it spoils. It is good economy, before commencing to build ponds, to take the advice of some experienced man, and also to read all obtainable works on the subject. On the main points there will be found very little difference of opinion, and on those comparatively unimportant everybody's experience will help you to form a sound judgment.

A few hints to those raising trout on a small scale; that is, not making it an exclusive business. There are many persons who have trout-streams, either wholly or in part on their farms, which streams bring them in no revenue, except an occasional day's amusement. Let us suppose such a stream to be stocked annually with five thousand trout-fry, at an expense of $100. In about three years the stream will be in full bearing. Let us look at the returns. At the lowest estimate three hundred pounds of trout, worth $1 per pound at present prices, may be taken from the stream annually. Then, too, there is always a demand for fishing privileges, and in most places such a stream could be let to sportsmen at a profitable advance on the cost of stocking. Besides, if a place is to be sold, a well-stocked trout-stream on the premises will add several dollars per acre to the value of the ground. Even a little spring rill, across which a man can step, if stocked yearly with a thousand fry, costing $20, will yield a profitable interest on the money expended. The labor of catching them is, of course, to be considered. But in most cases their capture is thought to be a pleasure, and if there should be a proprietor who finds no enjoyment in trout-fishing, he will find enough to do *that* work for him without wages. It must be obvious that stocking streams, though limited as to results, is yet in its degree more profitable than the other method of fish-raising, inasmuch as there is no outlay for feed, and the trout require no care.

The two methods may often be combined with advantage. I once met an old farmer who was taking a trout to the village hotel for sale. The fish weighed plump four pounds and was a beauty. I learned that he was in the habit of bringing such fish occasionally, and on questioning him, found that he had a little spring stream of water running through his land, and that in its course he had dug out a deep hole—simply a hole in the ground, without screens or apparatus of any kind. The larger trout from the stream collected in this hole, and he would feed them with scraps from his table, refuse meat from his butchering, &c. With the outlay of very little trouble, and no cash, the old gentleman must have gathered a good many dollars per year from his hole-in-the-

ground trout-pond. As a hint of what can be done in fish-raising with small means, his example is worthy of consideration.

There are a few erroneous impressions still lingering in the public mind which it might be well, if possible, to correct. No man need ever expect to make a more rapid fortune in this business than in any other. The same qualities which command success in farming or the mechanic arts, will command success in trout-culture. He who fails at everything else, will not succeed in raising fish. It has also been imagined that trout required no feed, and many ingenious estimates as to the profits of the business have left this item out of account. Now when the time arrives that pigs can be fattened without feeding, or calves turned into beef without food, then trout may be grown without expense. Food they *must* have in some way. In a natural trout-stream a limited number can forage for themselves; but trout in a pond are like cattle in a barn—they must have food furnished to them or starve. In other words, fish cannot live on water.

Another erroneous supposition is that large fish can be easily sent alive by express. It is not only exceedingly difficult to send large fish alive, but the cost of transportation generally amounts to more than the cost of the fish. The fry or young fish can be sent by express during cold weather only. Large fish must be transported in tanks and have an attendant to change the water and fee the railroad employés.

We have purposely refrained from making any estimate of profits. It would be possible to set down a very enticing row of figures. But so many elements enter into the question of profit, that no general estimate would hold good. We know just this one thing, that the business has paid us, and paid us better than any land-farming we ever heard of in this section of country; and if it has paid us, there is no law in this land forbidding one man to do as well as another.

WHITE-FISH.

The white-fish is very justly regarded as standing high in the list of valuable food-fishes. So much of the water of the United States is adapted to its growth that it would look, at first sight, as if the supply could not soon be diminished. A large amount of capital is employed in its capture, and a great number of persons are dependent for support, directly or indirectly, upon the continued supply of the fish. A very brief examination of the number taken yearly during the last twenty years will satisfy any one that the supply has decreased with alarming rapidity, and that at the present rate of failure the day cannot be far distant when it will cease entirely. It is hardly possible that the facts concerning these and other fish can be generally known, or they would give rise to an intelligent interest, which now seems to be almost wholly wanting.

Representations have been made to the legislatures of our various States, and to the General Government, in times past, by those who were aware of the facts and of their importance. But it is only lately that any disposition has been shown to listen to the warning and save these sources of wealth to our people. This is not the place for statistics, but a few brief facts may serve to show how the supply of the white-fish is diminishing.

Twenty years ago a haul of five thousand fish at one time, in a seine, was not an uncommon occurrence. Now the seine is not used, because no fish can be caught in that way. Twenty years ago the wholesale price was about $2.50 per hundred fish, retailing at 5 cents per pound;

now they wholesale at $17 per hundred, and retail at 12 to 25 cents per pound. The improvements in methods of capturing the fish also show the scarcity which made these improvements necessary. Twenty years ago fishing with the seine was the only method in use. But now, as I said before, the seine cannot be used, except, perhaps, at one or two points on the whole chain of the great lakes, and is, in fact, so far as white-fish are concerned, an obsolete method of fishing.

Next in order came gill-nets. These carried the war into the very home of the white-fish, being often set in three or four hundred feet of water. With these nets the catch became again, at first, productive. But the nets fished over every foot of ground, one boat often fishing six miles; and experience showed that three gangs of nets, of six miles each, would use up a fishery at any one point in eight years.

Again, the fish became so scarce that gill-netting would hardly pay, and the trap and pound-nets were invented. The trap-nets are of the same nature as the pound-nets, being only on a smaller scale. The pound-nets consist of a long leader with a pound or trap at the end. The fish run along this leader, or are *led* by it, into the trap at the end, from which they cannot escape. The leaders are often six miles long, and furnished with a trap at each mile. They are comparatively expensive affairs at the outset, and are set in water ranging from six to sixty feet in depth. The poles to which portions of the net are attached are often a foot in diameter, and are forced into the bottom by the aid of a pile-driver. No fish can pass this long barrier; the only apparent passage-way being at the trap-opening, and this opening being only a means of sure capture. Any one can see that such an engine of destruction must clean out all the fish within its reach.

Now, as even the old seine lessened the annual yield, and the gill-net very much decreased it, how many breeders does any one suppose will be left after the pound-net shall have finished its work? Even the pound-net fishing is nearly exhausted in Lakes Ontario, Huron, Erie, and Michigan, and in Lake Superior alone is this method extensively and profitably used. It is true that notwithstanding the decrease of the fish, the fishermen make nearly as much as formerly, because they charge an increased price. But it will take no wise prophet to foretell the failure of their business. They may raise the price until the last fish is drawn, and then——

Now, if it is true that the decrease of the fish has not decreased the profits of the fishermen, neither will the increase of the fish decrease their profits, as they will obtain more fish with less outlay of capital and less labor. Most of the fishermen already see this, and are not only willing but anxious to have the supply increased and the continuation of their business made sure.

If the fishermen are anxious to make the change, how much more anxious should be the general public. It can be demonstrated that a comparatively small outlay will very much decrease the price of the white-fish. In other words, by an indirect expenditure of less than one cent, we will be able to get for 25 cents the same weight of fish for which we are now paying $1.75. This may sound like "big talk," but it is not considered an extravagant estimate by those acquainted with the facts.

There are two methods by which the lakes may be restocked to their former capacity.

The first is by putting an end at once to all fishing, and trusting to the natural increase of the fish. Well, this process would take a thousand years or more, and the reason is this: The salmon-trout inhabit

the deep water of the lakes, in common with the white-fish, and their food is to a large extent made up of the young of the white-fish. Now, because the white-fish are more highly esteemed for the table, and are more easily taken than the salmon-trout, they have been decreased in greater proportion than the salmon-trout. In its natural state the lakes held so many breeding white-fish that the salmon-trout did not perceptibly decrease their numbers; the balance was maintained; but with the decreased number of white-fish breeders, and comparatively larger number of salmon-trout, the balance is lost, and the salmon-trout will keep the white-fish down.

The other method is by artificial hatching. If enough young fish are put into any one lake, the abundance of twenty years ago can be restored in four years. Let us take, for instance, Lake Erie. Most of the experiments already made with white-fish have been tried there; that is, experiments in obtaining and impregnating the eggs. The fish run up into the Detroit River to spawn, and are easily obtained. Hence at this point (Detroit) the habits of the fish at their breeding-time are known, the spawners are caught without difficulty, and we have all the knowledge necessary to restocking the lake. For restocking Lake Erie there should be put into the lake at least one hundred million of young fish annually for four years. That these young fish will live and grow is not now to be questioned. The fact has been definitely settled by the increase of the various shad-fisheries stocked in the same way. Of course not all of the number put in will arrive at maturity; a large proportion will furnish food to adult fish of other kinds, but certainly no larger proportion than is now lost in the same way. The proportion destroyed being the same, let us see what is the advantage of artificial over natural increase. Out of five thousand eggs laid *naturally*, one egg (*not one thousand*) will hatch out. Four thousand fish hatched out of five thousand eggs is a low estimate for *artificial* hatching, but even at this low estimate the increase of chances is four thousand fish to one fish. An appropriation of $15,000 per year for four years by the Government would be amply sufficient for the purpose—which appropriation, divided among the number of pounds taken, would not be anything like one cent per pound on the annual catch.

"One hundred millions of fish" has a rather large sound, and is, in fact, a very large number of fish. But the white-fish yields about ten thousand eggs to the pound of fish, and one hundred millions could be easily obtained. No trouble would be found in obtaining more if necessary, but the difficulty in the operation would be this: In order to obtain and take proper care of so many eggs skilled labor must be employed, and very few skillful workmen in this branch of art could now be found. The limited operations of the various States which have engaged in the enterprise of restocking their waters, and the numbers of private breeding-establishments, have added somewhat to the number of skilled laborers; but all such are in great demand, and men would have to be trained especially for the work.

The white-fish spawn generally about the month of November. Naturally they cast their eggs in from 5 to 20 feet of water, over springs, if they can find them; or, if not, near the shore, on gravelly bottom. The female, when ready to spawn, may be seen swimming round with a half dozen males in close pursuit. When she is about to cast her eggs one of the males darts to her side; they press against each other, and the eggs and milt are emitted simultaneously. This may take place near the surface of the water or lower down; but, wherever they may be, as soon as the eggs are thus spread broadcast, all the fish in the

neighborhood start for them and eat up all they can find, while the parents themselves are not backward about taking their fair proportion. Only a few out of every thousand escape being eaten. I have found three thousand eggs in the stomach of one fish. Of those which remain, by far the largest part are covered up by sediment, or fall into places where there is no change of water, and never produce fish.

The method of artificial impregnation and hatching pursued with the white-fish eggs is very much like that in use for the eggs of the brook-trout. So many are taken at one time and in one pan that, as a measure of precaution, the pan is gently shaken at frequent intervals, in order to secure contact of the milt with all the eggs. This motion prevents the adhesion to the pan and to each other which is seen in the newly-impregnated eggs of the brook-trout. But, even if left at rest, the eggs do not exhibit the same tendency to stick as the trout-eggs. After being washed they are laid in gravel troughs, or on trays similar to those used for hatching salmon-trout. (M. G. Holton has invented a new hatching-box, for hatching white-fish, that is a great success.) For immediate transportation packing in moss is the best method, but is not practicable; and the eggs are either carried in water or brought "dry," that is, on trays arranged in layers in a pail or box, and without the use of water or any packing material. If jars are avoided, and a low and even temperature can be preserved, they will very well bear dry transportation. The period of incubation is about the same as that of the trout and salmon, being about sixty-five days at a temperature of forty-five degrees.

When the young fish break out of the shell very fine wire-cloth is required to keep them. The eggs are only about one-eighth of an inch in diameter, and the young fish when first hatched about five-eighths of an inch long. The umbilical sac is small, and in about ten or twelve days it apparently disappears. The fry have no period of helplessness like the young of the trout and salmon, but commence to swim as soon as they emerge from the shell. These facts show that it is a good variety for propagation in large quantities, inasmuch as it is able, like the shad, to take care of itself at once, and does not need the thirty or forty days' care required by the brook-trout, salmon, and salmon-trout. As soon as set free it heads for deep water, where it is in comparative safety and finds food enough for its wants.

With regard to the question of food, the small fish live on the minute forms of animal life found in abundance in the lakes. The experiment of raising the young fish on artificial food has been tried several times, but never successfully. The reason seems to be simply that the food cannot be finely enough divided. The young fish is almost transparent; and, by keeping a few in a glass jar or tank, you may see them take the food, may see it in their stomachs, and see the droppings passing from them. A few may be thus fed very easily; but such feeding is not practicable on a large scale, nor is it from any reason necessary.

Their growth varies of course, but they may be said to be of age when three years old, although they will increase in size until four or five years old. In the lakes their average size is about two and one-half pounds.

The question may be asked, What waters are suitable for white-fish, and should be stocked with them? They require deep, clear water, with gravelly or rocky bottom. These conditions are fulfilled in all the large lakes, and also in very many of the inland lakes. For instance, in New York State alone, we have six hundred and forty-seven lakes, of which at least one hundred are well adapted to the growth of this fish. Of

these lakes, perhaps fifty either are now, or have been in times past, the home of some variety of the white-fish. But in none of the inland lakes of New York are they now to be caught in paying quantities. Think how much would be added to the wealth of New York State alone if these one hundred inland lakes were stocked to their full capacity.

In reference to our large lakes there is one point which will have to be settled before any attempts at stocking are made. As these lakes form, in part, the boundary between Canada and the United States, and as the Canadians have, of course, an equal chance at the fish, some arrangement must be made whereby they shall pay their share of the expense, or do their portion of the work. I am happy to say that the project is favorably considered by the Canadian authorities having charge of fish-interests, and it is probable that a fair compact can be made.

As to the proper methods of restocking the lakes, the details only are now a matter of experiment. The great facts are established and ready for use. It is likely that the hatching-houses should be placed at the point where the eggs are taken, since it is much easier to transport the young fish than to transport the eggs. The first costs more, but in the long run is probably least destructive. In closing this section, I wish to insist upon one thing. If any attempt is made to restock the great lakes, or any one of them, means enough must be provided to do it fully and completely. There is no possible good in dribbling a few thousand fish yearly into a hundred-mile lake, and the money used in such a way is simply wasted.

There is one curious fact about the white-fish which I have never seen noticed in print, and wish here to put on record. The white-fish (and also the salmon-trout) have, during most of the year, except at spawning time, a certain swing on and off shore. They will swing out, say, fifteen miles into the lake, and then back again until within two miles of the shore. The men who are fishing for them are well aware of this swing, and set their nets out or in with reference to it. But the curious fact is this: that at a certain season of the year, somewhere from the middle of June to the middle of July, the white-fish forsake their accustomed haunts, and make a sudden night journey to some sand-bar, close in shore, where they may be seen in great quantities. This visit lasts about ten days, and then they all return to their former grounds and accustomed motion. What may be the reason of this visit I do not know. It looks to me like a summer pleasure excursion on a large scale. There must be some good reason, of course, and some time it will come to light.

SALMON-TROUT.

The rate of decrease of the salmon-trout has not been so great as that of the white-fish. This is owing to the fact that it is a deep-water fish and the difficulty of catching them is thus increased. The rate of decrease has been rapid enough, however, to excite well grounded fears of their total extinction. Witness the following facts; they used to be sold at \$2.50 or \$3 per hundred pounds; they are now sold at \$7 per hundred pounds. This fact on its face would seem to indicate a failure of more than one-half of the old average, but in reality it indicates much more, because improved methods of catching them are now in use. That the decrease is more than one-half is sufficiently shown by the fact that not so many are now caught in two miles of gill-net as used to be caught in forty rods of gill-net. Besides this, in old times, owing to

the scarcity of fishermen, only a portion of any one lake was in use at one time, but now, in order to keep up the supply, almost the entire area is netted. Now the salmon-trout do not roam over the whole lake, but any particular school of fish may almost always be found on the same ground. So long as only a portion of the ground was netted, some families had a fair chance to increase, and by their overflow to fill up the rest. But now, when all the water is fished, and gill-nets are used, and the spawning-grounds become the greatest scenes of slaughter, the number of spawners must decrease very fast.

A little bit of personal experience will give a better idea of the above facts. In the year 1837 I went to Port Hope, Canada West, (on Lake Ontario,) to fish for salmon-trout with set-lines.* This was the first fishing for salmon-trout with set-lines ever done in any of the lakes. I used to fish out and in, not further than six miles from shore, sometimes using nine miles of set-line. The average catch the first year was one hundred fish on one hundred and fifty hooks, and the fish averaged eight pounds in weight. The second year the average was about sixty-six fish to one hundred and fifty hooks; average weight being about the same. The third year the catch was thirty-three fish to one hundred and fifty hooks, and the weight began to decrease. The fourth year the average catch was about fifteen fish to one hundred and fifty hooks, and the average weight only four pounds. This showed that the fish had been thinned out in that locality.

In the fifth year I moved fourteen miles to another ground; and there the fishing for the first year was of the same average catch and weight as at Port Hope, and in succeeding years showed the same rate of decrease. If I had been the only fisherman on the lake, this moving might have been repeated indefinitely, with the same result; as the local schools would have had time to grow before I got round to them again. But fishermen began to multiply, and when all places were fished at once, no one place had any chance. These set-lines ran about ten years, and then the highest average to be obtained anywhere was fifteen fish to one hundred and fifty hooks; the fish averaging four pounds in weight. As this would not pay, in 1847 gill-nets came into use, and since then the catch has annually decreased.

In a natural state the salmon-trout spawn on rocky reefs in from three to fifty feet of water. They will spawn in any place where they can find such reefs; often twenty miles from shore. They yield about one thousand eggs to the pound of fish, being only about one-tenth as many as the white-fish. The method of spawning is the same as that of the salmon and brook trout; a nest or hole being made for the reception of the eggs. In regard to these eggs the same story must be told—most of them are eaten before they are ten minutes old. It must be remembered that all fish are inordinately food of fish-eggs. The salmonidæ will not only eat them while falling, but, contrary to their usual habits, they will poke and root in the mud of the bottom to find those which drop. The eggs also are destroyed by wild ducks. These ducks will gather over a spawning-ground as soon as the fish commence to spawn, and will remain there till frozen out. The size of the spawning-ground can generally be told from the size of the flock of ducks over it. It may be generally supposed that as the fish spawn in deep water the ducks cannot do much injury to the eggs. But the fact is that they will take them

* I would here humbly confess that I have done perhaps as much toward the depletion of the lakes as any other fisherman; but would plead in extenuation that I was like all fishermen, and wanted the last fish and would take it if I could. I am now, as a penance for my sins, trying to do all in my power to repair the injury.

from a depth of thirty feet. The few which escape these dangers must fall into fissures, or under thick weeds or be covered over with sediment; and in such situations it is only a very few which can have change of water enough to hatch.

For the last three years New York State has been extensively engaged in the hatching and distribution of salmon-trout, for the purpose of stocking its inland waters. The processes here described are those in use at the New York State hatching-house, at Caledonia, on the grounds of Mr. A. S. Collins. The eggs have to be obtained, of course, from the breeding-grounds in the lake. In order to get them men are sent out to the grounds at spawning-time; arrangements are made with the fishermen, and the men go out with them when they take up their nets. As the nets are hauled in, the fish which may happen to be ripe are stripped of their eggs. Impregnation, &c., the same as that of the brook-trout. The eggs, when first taken, are kept in shad-hatching-boxes, at some convenient point in the vicinity, until enough of them are gathered to send one batch to the hatching-house. The eggs are brought either dry or in water. One hundred thousand eggs can be sent three days' journey in a wide, eight-gallon milk-can filled with water, by changing the water every four hours. Upon arrival at the hatching-house, for the sake of saving room and of convenience in handling, the eggs are placed upon wire-trays, fourteen inches wide by twenty-four inches long, and these trays are laid four deep in the hatching-troughs. The frames are so arranged that the water is evenly divided and flows evenly over the whole surface. The eggs are at present taken under unfavorable circumstances. A fisherman's small boat is hardly a place in which to perform the dainty process of impregnation; and when, in addition to the want of room, the boat is standing sometimes on one end and sometimes on the other, the men being frequently wet through to the skin, and the thermometer down among the thirties, it is a wonder that any eggs are impregnated. In the face of these difficulties, the impregnation last year was between 60 and 70 per cent.

As it is about five weeks before the impregnation makes itself manifest, only the bad eggs which die can be removed before that time; and for the purposes of picking out the unimpregnated eggs and keeping the good eggs clean, the trays have been found very handy. They can be taken out of the water, cleaned with a watering-pot, and set back in a clean trough without any injury to the eggs. Of those which are impregnated, scarcely 1 per cent. die after removal to the hatching-house. The period of hatching is about sixty-five days. The young fish, when first out of the shell, cannot swim, can just "wiggle" about and, loaded with the umbilical sack, hide in corners and under stones. In about forty days the sac is so nearly absorbed that they begin to swim and come to the top of the water for food. If they are to be used for restocking lakes, this is the period for their transportation. They are taken before the sack is entirely absorbed, because then they require no food on the way and less change of water. They may be carried in tanks of any kind and emptied into the head-waters of the lake to be stocked. This should be done in the night, when their enemies are not feeding, and they will find hiding-places before morning.

It does not look at present as if the white-fish could be made a pond-fish; at any rate the point is not determined. But I think the salmon-trout may be easily grown in ponds. The State of New York has no grounds suitable for trying such points. But Mr. Collins has been trying a series of experiments under my personal observation, which are,

so far as I can see, reliable. The young fish, when ready to feed, were tried upon various diet. Liver alone was used, liver and cream mixed together, beef, beef-heart, curd, &c. Any one of these was taken voraciously. In fact, not the slightest trouble was experienced in getting the fish to eat. The only trouble was to feed them enough. They seem to grow while young faster than the salmon or brook trout, and of course feed in proportion. It is known that adult fish, or those nearly grown, may be kept for a long time at very nearly the same weight by feeding them but little food. This is not the case with young fish, as a certain rate of growth must be kept up or they will die. For instance, if at any one time one pound of liver per day gives food enough to a certain number of young salmon-trout, in two weeks' time, if fed on the same weight of food, they would not continue of the same size, but would nearly *all die.* The food must be continually increased in quantity.

The experiments were made in the press of other work, and therefore were not perfect. But even with some inevitable neglect, at one year of age the trout averaged six inches long, and if they had been fed as much as possible would have been two or three inches longer. In two years the fish had doubled in size, and were all handsome, bright, and healthy fish. They are an easy fish to raise, and those who wish to go into the business of raising brook-trout are recommended to commence with the salmon-trout, as the methods of hatching and growing are similar. A beginner will be far more likely to succeed with the salmon-trout, and thus gain the necessary experience for raising brook-trout.

Only a small appropriation has been made yearly by New York State, and it has been impossible to do much. Some of the larger inland lakes have been partially stocked. No very great results can be expected from this small scale of operations. Still the experience and training which it has afforded makes us ready to enter successfully into larger labors. Besides this, public opinion has been educated and directed until we believe that now but few voices would be lifted against the attempt to thoroughly restock every lake in the State; and without the public sentiment in our favor we could do nothing. It has been only three years since the first salmon-trout eggs were brought to the New York State hatching-house; about two years and a half since the first partial distribution of fish, and from many points where a few thousand had been put into some lake, the report has come back that young fish had been seen there in unusual quantities. This result is as satisfactory as, under the circumstances, could be hoped for, and gives the assurance that any attempt, with full means at command, will be surely successful.

SHAD.

As an edible fish the shad stands very high in the estimation of our people. Much attention has been paid to it during the last four or five years. In fact more general interest has been attached to the culture of shad than to the culture of any other fish, not even excepting the salmon family. The causes of this interest are various. The need of some method of hatching shad-eggs had long been felt and very many experiments had been made with a view to its discovery. The means of hatching the eggs of many other varieties were known, and it seemed to be not a hard task to find a way to hatch shad-eggs successfully. But notwithstanding the apparent ease of the task, the way was not found for a long time. Public interest

was attracted to these experiments and to their successful termination because of their importance; also because whatever honor may lie in the discovery is due to an American citizen; and, besides, shad-hatching was a *clean* invention; that is, it was not a rediscovery, as no one had ever hatched shad-eggs successfully before, nor is the honor of the discovery disputed.

The shad is one of the most important of our commercial fish, and may be made perhaps the most important. This possibility arises from the geographical distribution of the fish, from its habits, and from the extent of the waters to be stocked with it. In times past the shad ran up into all the rivers emptying into the Atlantic from Florida to Maine. From various experiments, not to be detailed here, it is manifest that they can be introduced into the rivers which empty into the Gulf of Mexico, and also into the rivers emptying into the Pacific. Therefore, as the shad has a very wide geographical distribution, the process for its propagation can be very widely used. Then its habits render it one of the best of all fish for artificial propagation. It always returns to the river in which it was hatched, so that efforts to increase the yield of any particular river will not be lost or go to swell the catch on the whole coast, but will benefit directly only that particular river, and thus afford a sure return for the labor expended.

There is also a very good economical view of the case. The young shad, when first hatched, live for a longer or shorter time in our rivers and derive their feed from the river-waters. But there is so much feed, and the diminutive shad eat so little, that there is feed enough for incalculable quantities. Before they grow much they drop down into the boundless ocean, where feed is equally plenty, and then when they run up again full grown into the rivers to spawn they *do not eat*, until their return to the ocean, so that our rivers are taxed but little.

Again, the eggs hatch in a very short time, and the young fish at birth is measurably able to take care of itself. Besides this, the extent of water adapted to its culture within the geographical range is exceedingly vast. Our country is noted for the number, size, and extent of its rivers. It is nearly surrounded with water, and almost the whole of the rivers and that part of the oceans lying near the shore may be made to contribute to the growth of the shad. And, still again, as in the spring of the year it forces its way up our long rivers to their sources, it affords for two months an excellent chance for its capture, while for the remaining ten months of the year it makes for itself a practical "close time" in the deep water of the sea.

Various fragments of the history of artificial shad-hatching and of the operations of the various States, and their results, have, from time to time, appeared; but as these fragments are scattered through newspaper paragraphs, reports of the commissioners of the various States, memorials to legislatures, speeches, &c., and as I have been connected with shad-culture from its commencement, I have thought it would be of interest to give a brief and connected account of the operations of the last five and one-half years; and that such an account would possess a permanent value. I may also, perhaps, be pardoned if I dwell a little on my personal share in the history, since my adventures will show the obstacles which were to be overcome, and what a thorough revolution has been made in public opinion in regard to the whole subject of the artificial increase of fish.

A great many attempts had been made previous to the year 1867 to hatch out shad; most of the trials being made on the Connecticut River.

None of these attempts were successful. If they had been successful I certainly should not have been asked to attempt the discovery. At last, after various persons had been at work for years on the problem, the commissioners of the four States, Massachusetts, Connecticut, New Hampshire, and Vermont, came to my place at Caledonia for the purpose of urging me to come to the Connecticut River to try and make shad-hatching a success. Of course I could not tell what the experiment would cost, and since so many had tried in vain I had good reason to fear that I should not succeed. The commissioners offered to pay me for the attempt, but as I felt some pride in the matter I offered to come and try the experiment at my own expense, provided that if I was successful they should pay me what was right.

On June 29, 1867, I arrived at Holyoke. As a stranger, I was of course the object of some curiosity to the village people. I thought I would talk with some of the fishermen and try to interest them in the project. Accordingly I told them for what I had come, and what I was about to do. The surrounding crowd really did begin to be interested in my talk, but greeted me with expressions of unbelief more forcible than elegant.

Of course, I was thankful for such little expressions of encouragement, and they naturally made me feel very cheerful. When I went to look for a boarding-place, I could not find any; or at least a day or two was the limit of my stay at any one place. The house was full, or they expected some one else, or something was the matter. At first I could not get men to haul a seine for me, in order to get breeders. But as money is all-powerful, at last a few of the men contemptuously offered their services for "a consideration," and on June 30 I made the first haul of one hundred and twenty-five fish. The men looked upon me as a lunatic, and very naturally treated me as such. I got the pans ready. Some one handed me a ripe shad, and I commenced to take out the eggs. Then they all surrounded me, with a shad in each hand, and commenced to poke at me dry fun and vulgar wit; while, as if by accident, every now and then a shad would slip from some one's hand and be pretty sure to come into contact with me before it fell, until, when I got through, I was covered from head to foot with blood, milt, and slime. Nevertheless, I took about one million eggs that time, all well impregnated, and left them in the pans. The next morning I was up by four o'clock and had troughs made for the eggs by noon. I found the eggs doing tolerably.

July 2.—I suppose the fishermen thought I was going a little too far, for when I went in the morning to visit the hatching-troughs, I found the water all shut off and the troughs broken down. I am not ashamed to say that, as I looked, a few drops, which were not rain, ran down my cheeks. Some of the inhabitants of the place came down to where I was, and on seeing the broken-down boxes and my disappointment, said to me the first kind words I had heard since I came to the place, (except from the commissioners.) I am not trying to make myself out to be a martyr. The opposition was only petty and vexatious, but it illustrates exactly the state of public opinion on the question five years ago. After that time I watched nights.

I tried all sorts of troughs and boxes. At first I tried to hatch the eggs in troughs similar to those used for hatching brook-trout, but found that this would not work. The shad-eggs were so light that a very little water passing through the trough washed them out. Then I built bars of coarse gravel across the troughs at intervals, and let on current enough to wash the eggs into the gravel. By this method about 1 per

cent. hatched out. I then made up my mind that the eggs would have to be confined so that they would not get away and still could have sufficient change of water; so I took old boxes and, knocking out the ends, substituted wire-cloth and put the boxes in the current. This arrangement answered better, but the eggs were carried against the side opposite the current and lodged there, and many died of suffocation. I thought if I could let in the current from the bottom it might keep the eggs from packing against the sides, so I made some boxes with wire bottoms. This proved a gain, but was not yet the thing, because the eggs had a tendency to heap themselves into the four corners of the box. I suppose I made twenty different kinds of boxes, the one answering best being a box with wire-cloth bottom and sides partly board and partly wire. But the percentage of eggs hatched was not yet what it ought to be. I also laid some eggs in various positions on gravel in the bed of the river; of these about one egg in two hundred hatched out. This was simply done by way of experiment, as I had often heard (and hear yet) of eggs being laid into river-water and there hatching. Well, I was satisfied that some shape or form of box, placed in the river-current, was to be the desired method. At last, one day I happened to be standing in the water holding a box full of eggs. This box was one of those which had board sides and ends and wire-cloth bottom. As I was holding the box carelessly in my hands and thinking over the problem, one end of the box happened to turn upward against the current. Immediately the eggs, instead of lying still and in heaps, commenced to boil upward with a gentle and steadily-continued motion. One look was enough. I had found the secret. The only thing necessary was to keep the end of the box toward the current turned up, so that the current would strike obliquely against the wire bottom; and this I accomplished by means of floats nailed to the sides of the box at the desired angle. I made two formal experiments with this box, using in each ten thousand carefully taken eggs. In the first experiment all but seven eggs hatched; in the next all but ten eggs hatched. It may be well to say just here that I at once took out a patent on the box, and that it cannot be used except with my permission. But I have been getting ahead of my story.

On July 3 I found that the river boxes were doing well and those in the creek were not; so I abandoned the latter. On July 4 I could plainly see a living formation in the eggs. July 5, forty-five hours after impregnation, I plainly saw the young shad in the egg. As I was watching that night by the water-side, a fellow came down and was wading off to my boxes. I ran out and hailed him. He attempted to run off, but I ordered him to come up, which he did when the argument was enforced with a revolver. He said that he saw something in the river as he was passing, and thought he would wade out and see what it was. I patiently explained the whole thing to him, and he listened just as if he had never heard of it before.

The next day, July 6, at 2 p. m., the first shad hatched out, in fifty-eight hours, with the water at 75°. On July 7, 1867, I put into the river ten thousand young fish, being the first artificially hatched shad ever put into the river. After I had found the slant in the boxes, hatching was very easy work. But this was not the end of the business, for I did not yet know what to do with the young fish. In solving the problem, the first thing to be discovered was where the young fish went to, after being hatched. I knew that the young trout sought the shallow places near the shore, where the larger fish could not get at them. So at first I put the young shad into shallow water near the margin of the

river. I found that this would not do, because the minnows took them even while I was putting them in. There were also schools of minnows around the hatching-boxes, and as soon as I turned them over to empty out the young shad, the work of destruction commenced. I caught one minnow, one minute after I had turned out the young shad, and found eleven in his stomach. In order to gain time for working out this problem, I built a kind of pond with stones on the bank of the river, and put in the young fish. The next day, when looking for them, I found that they had all apparently escaped. But the banks of my pond were made tight with gravel and I did not think that the young fish could get through. While looking intently into the pond, I saw a little wriggler passing over a white stone at the bottom, and then I remembered that the young fish were almost transparent, and that it was hard to see anything of them except the eyes. By watching the stones at the bottom I found that all the shad were collected in the deepest water of the pond, or that part farthest from the shore. Here was a revelation; but in order to be certain of this new order of things, I tore down the outer portion of the pond-wall, and built it out farther, into deeper water. I put in some more shad, and, remembering the experience of the day before, I strewed white stones over the bottom and sunk white paper. The next day I could easily examine the whole pond by aid of the stones and paper, and found, as I expected, that all the fry were again gathered in the deepest water, or that farthest from shore. It was all plain enough now. The young shad, as soon as they emerged from the shell, sought the middle of the river. They were too small to be noticed by the large fish, and the minnows, their enemies, did not dare to come into the deep water after them, lest they in turn should become food for the larger fish. While experimenting in the ponds I had obtained a drug, and with it killed all the minnows in the vicinity of the boxes, and then turned out the fish. But so many relations came to the funeral that I was obliged to relinquish this plan. I then went some distance above and roiled up the water, and as soon as it became so muddy that the minnows could not see to take the shad, I emptied the hatching-boxes. This was at best a clumsy arrangement, and was discarded as soon as I had found out that the fry sought the deep water. After this the boxes were towed into the middle of the river and emptied, until I happened to remember that the minnows did not feed at night, and after that the boxes were emptied at the hatching-stand at night, as the fish would find their way into the middle of the river before morning light. Still further to test the question of the place of their abode, I took a dipperfull of young fish and sank it slowly beneath the surface of the river, near the shore; the fry rose up out of the dipper, and without one exception headed for the middle of the river. I tried it again a little further out with the same result, and then I went across the river to the other shore and tried it there with still the same result.

I thought then that I "knew it all," but there was one more thing to learn, and that I did not find out till some time after. In July, 1868, my eggs began to suffer from some cause; I could not find out the reason. I had no suspicion at first that the water could be too warm for them; but, as I remembered that for some days the weather had been exceedingly hot and sultry, I thought I would see if the heat had anything to do with their failure to hatch; so I put a row of boxes into the mouth of the creek, extending them out into the river. On examining them next day found the temperature of the boxes in the river at 82°, and the eggs all dying. At the other end of the string the temperature stood

at 70°, and the eggs were all good in the creek boxes, until the river-water was reached, and there the eggs were suffering very badly. This gave the reason at once, and I found that a temperature of about 75° was the best for hatching purposes.

Well, the thing was done; the method was perfect, and has not been improved since; I felt proud of it. That season I not only invented and perfected the method, but put into the river over fifteen million young shad. My expenses while there were over $300, besides the neglect of business at home. But then I had succeeded, and the commissioners who had solicited my assistance were highly gratified, and were pleased to say that I had made a great discovery, and one which would be of incalculable benefit to the people at large, &c. I did not expect any very great pecuniary reward, except that my expenses should be re-imbursed. Imagine, then, my feelings of grateful astonishment when I learned soon after that the four great States of Massachusetts, Connecticut, New Hampshire, and Vermont had each voted me $50 (or $200 in all) to repay my expenses—pay me for time and work, and as a token of their grateful appreciation of my services.

The next year I went to Holyoke again, and that season put into the Connecticut River about thirty million fish. I thought that this would probably make some impression on the river, but was afraid that, because of the low number of shad, and the great number of their enemies which the young would have to encounter on their way to the sea, that most of them would be eaten before they attained their growth.

There had always been a dispute about the time which it took for a shad to grow to its full size. The opinion was then general that it took just one year; that the fish was hatched out in the spring, attained its full size by the next spring, came up into fresh water, laid its eggs, and died. I did not believe this, and, reasoning from the growth of fish with which I was acquainted, I maintained that the period was at least three years. One year passed away. If the general opinion was correct, then my work of 1867 did not show any result, as the catch was no greater than usual. If my opinion was correct, then the spring of 1870 was the time for the fish to show themselves; 1869 came, there were no signs of increase, and the catch even less than usual. The spring of 1870 came, and brought with it the long-expected fish. I quote from the report of the commissioners of Massachusetts, dated January, 1871, page 4:

On Sunday, May 21, (1870,) vessels in Long Island Sound observed the unusual spectacle of vast schools of shad. The next day they struck in at about the mouth of the river and filled the nets. At Lincoln, ten miles from the mouth, and on the coast, three thousand five hundred and sixty fish were taken in one pound, (five hundred is usually a large catch,) and the total yield of the pounds for that day was over twenty-five thousand. At Haddam Island, a short distance up the river, seven hundred were taken with one sweep of the seine, which is more than one-third the yield of a similar seine for the whole of the previous season. A seine, four miles below Hartford, took nine hundred shad the same day. As this is some fifty miles up the river, it is plain that the schools struck in all at once, and that those which headed for the stream kept on with great rapidity.

Now, it does not appear that on the Hudson to the west, or on the Merrimac to the east, the run of shad was unusual. On the contrary, both those rivers report a small average. Whence, then, this *local* phenomenon? The Connecticut people call them "Green's shad," attributing the increase to the artificial hatching by Seth Green, at Hadley Falls, in 1867, and this opinion gets color from the fact that, in 1868, the small yearling fish were unusually plenty.

Fifteen millions of young shad were put into the river in 1867, and about thirty millions in the spring of 1868; therefore, if the three years theory of growth held good, more shad would be taken in 1871 than even the large catch of 1870. The spring of 1871 was awaited with great interest. The catch of 1870 might be an exceptional one, from

unknown causes, and not arising from the artificial hatching. But if 1871 showed an unusual yield, and an increase over the yield of 1870 proportioned to the increased hatching of 1868, then there would be no reasonable doubt of the immense value of artificial hatching. The result was that the catch of 1871 was better than the catch of 1870. Previous to this date (1870) the largest catch ever known, or of which we have any record, was made in the year 1802, and the catch of 1871 was 60 per cent. larger than the great catch of 1802.

But we have still further confirmation. In the year 1869 very little attention was paid to hatching shad on the Connecticut. Nothing was done by the commissioners of fisheries, and only a few were hatched out by an outsider. The catch of 1872 exactly corresponded to this record. It was a tolerably fair year, but not to be compared with 1870 and 1871. The great catch of 1870 again aroused public interest, and in the spring of that year sixty millions of young shad were hatched and put into the river. It will not take very much of a prophet to predict that the catch of 1873 will be the largest ever known.

When I first went to Holyoke in 1867 no shad was sold there for less than 40 cents. The natives and fishermen did not think of eating them. Perhaps they could afford the luxury of one shad in a year, so that they might be able to say that they had tasted shad that season. Now, what we want to do with shad is to take them out of the list of luxuries and make them so cheap that the poorest man can have them on his table. It can be done; the people have the power in their own hands, and I hope to live until I see it accomplished. I believe that the number of fish can be so increased that the run of shad will actually cause a rise in the river. I believe that they can be so increased as to allow any man to fish for them at any time he pleases and in whatever way he pleases. Personally, I would prefer a close time of twenty-four hours on Sunday. But the number of fish can be made so great that a close time will not be necessary. The rivers can be made absolutely full of them. All the fish want is room enough to spawn, and the nets will make room enough for that purpose.

In June, 1868, I commenced hatching out shad on the Hudson River, under the direction of the New York commissioners of fisheries. The usual difficulties were again encountered. For the purposes of hatching breeders have to be obtained at one of the fisheries. The best place I found for this purpose was some three miles from a hotel. I tried to obtain board at some of the houses near the place where I was working, but the people looked upon me as a good-natured lunatic and closed their doors. I walked to a hotel several nights, and finally bought an old canvass awning, made something like a tent of it, and "fought it out on that line" for the rest of the summer. That year the spawners were few in number and the season was filled with various experiments as to the best conditions of place and time, very few shad being put into the river. The swell caused by passing steamboats and by heavy winds was very fatal to the eggs, and the hatching-boxes were therefore removed behind an island, where they had a good current of water, but yet were protected in great measure from the swells of the immense Hudson River steamers and from the waves in a hard blow.

In order to show the state of the river at that time I quote from the report of the New York commissioners of fisheries, date March, 1869, page 7:

* * * * A thorough examination of the fisheries on the Hudson was made. This was commenced on the 4th of June, (1868,) when the nets in the lower part of the river were being taken up, as the main run had then passed. Great com-

plaint and dissatisfaction were encountered everywhere, the fisheries having fallen off immensely, although the enhanced price paid by the consumer somewhat indemnified the fishermen for this scarcity, but the public generally suffered in consequence. There never before had been so few shad taken, and the retail price in market rarely fell below 75 cents for fish which ten years ago were sold for 10 and 15 cents apiece. Near Carmansville and in that portion of the river where the nets were not up the fishermen were not averaging four fish a day; higher up they were doing somewhat but not much better. Scarcely any shad pass above Albany, where in former times they were most abundant, as they cannot run the gauntlet of the nets below. At the time when your commissioners examined that section, the seines were not taking over one shad to a haul.

Let us bear the above in mind and compare it with the story to be told four years later.

In the spring of 1869 there were hatched and put into the river about three millions of young. The reason why more were not hatched was, that not enough spawners could be obtained. In 1870 there were hatched out about two and one-half millions, in 1871 about eight and one-quarter millions, and in 1872 about eight millions.

According to the theory that the fish would return full grown in three years, there should have been a slight increase in 1871, a larger increase in 1872, and should be a larger increase still in 1873 and 1874. The fact was that the yield in 1871 was larger than usual on the Hudson, although the immense yield in the Connecticut that year glutted the market, put down the price from $18 per hundred to $3 per hundred, and overshadowed the slight increase in the Hudson. In 1872, to speak entirely within bounds, the fishing was more than twice as good as at any time before in twenty years. Any amount of fish sold at from $3 to $5 per hundred, whereas the usual price was $18 to $30 per hundred. The boats refused to take them any more unless the freight was prepaid; dealers in the cities wrote to the fishermen to stop sending, and many dealers who had contracts with the fishermen broke their contracts and paid the forfeit money, rather than submit to a greater loss. The men stopped fishing, as it would not pay. It was the first time the market was ever glutted.

Now, in comparing this abundance with the previous scarcity, I wish to note that the dealers and fishermen were no more dissatisfied with the latter abundance than with the former scarcity; abundance of fish and low prices caused no more grumbling than high prices and a dearth of fish. In order to be entirely satisfied, their human nature required an abundance of fish and the highest price ever paid. The general public are thankful that the two last facts are not likely to be found together.

Again, in looking at the last statement of the abundance of fish, that it was so great that many were lost, and that the fishermen had to stop netting because there was no sale, the question very naturally arises, what more does any one want? What is the use of putting more fish in, when there are too many already? Are there not now enough to satisfy the demand? Yes, enough to satisfy the *existing* demand. But bear in mind the following facts. The increase in the supply was altogether unexpected by the fishermen and dealers. Arrangements and contracts had been made to dispose only of the usual supply at the usual price. Shad had come to be a luxury found only at hotels, restaurants, and on the tables of the rich; and as the price was exorbitant the demand was limited. When the sudden influx came, the demand did not proportionately increase. People had ceased to think of shad as a regular article of diet, and there was no time to create a demand and no facilities for supplying it if there had been. Should the increased

supply continue with regularity and certainty, there will be no difficulty in disposing of the catch—no more than there used to be twenty or thirty years ago with a very much smaller population.

Then, again, twenty years ago, salt shad were just as much an article of commerce as salted mackerel are now. In this day no one ever hears of salt shad, and all along the Hudson, Potomac, Chesapeake, and Connecticut stand the ruins of salting establishments.

In the month of June three tents may be seen standing on the west bank of the Hudson, about nine miles below Albany. In these tents live the men engaged in the shad-hatching. About dusk they go down to the fishery, taking with them the necessary pans, &c. Some of the fishermen are engaged to haul a seine every night during the season. As soon as the men arrive, the fishermen make the first haul, generally about 8 p. m. A boat is stationed at the place to which the net is to be drawn, and the fish are handed from the bag of the net to the men in the boat, and the eggs at once taken. As soon as the fish are all handled, another haul is made, and the fishing is continued until about 12 p. m., the largest hauls being those first taken. The eggs are taken in tin pans, about twenty thousand in each pan. When first taken they are about nine-hundredths of an inch in diameter, but in a short time (twenty minutes or less) swell to thirteen-hundredths of an inch; at the same time the temperature of the water in the pan is found to have lowered 10°. After impregnation the eggs are thoroughly washed, and are then ready to be put in the hatching-boxes. This is done immediately after the hauling is over, at 12 p. m.

The hatching-boxes now in use are made of pine sides, fifteen inches wide, twenty-one inches long, and ten inches high. The bottom is covered with wire-cloth of eighteen meshes to the inch. The floats now used are no longer than the box, and are put on at an angle of one inch in four. The wire-cloth is dipped in hot gas-tar to prevent rust, and the sides are also coated with the same material. The reason why tar is used in preference to paint, is because paint kills the fish and tar does not. The boxes are tied together in gangs of six, each box being turned broadside to the current, and anchored out so that they will swing with the tide. As the tide turns twice each day, there is a period of about two hours at slack water when the current is not sufficient to straighten out the strings, and it is the duty of one man to attend at such times, and at intervals move the strings of boxes, and thus give the eggs a change of water. The boxes containing fish ready to put into the river are marked in the day-time, and at night, when the newly taken eggs are placed in boxes, the fish are emptied out. There in no use in towing them out to the middle of the river before setting them free, as they will find their own way to deep water before the morning light brings danger. Every day the boxes are examined and thoroughly cleaned; this is a work of some delicacy when they are full of eggs. About two hundred boxes are used, (costing 25 cents each,) hatching about ten thousand eggs at once.

Some experiments have also been tried in transporting and transplanting shad. As the eggs hatch so quickly they can be carried only to short distances, but the young fish can be carried and kept alive for a long time. About fifteen thousand fry in 1871 and sixty thousand in 1872 were put into the Genesee River, below the falls. All shad, so far as known, migrate to salt-water; and the New York commissioners desired to make this experiment in order to see if a migration to the lakes would satisfy the shad, and be sufficient for their growth. It is not

time yet to expect any results, but the yearling fish have been seen in the river.

A number of the fry were also taken safely to Saint Paul, Minnesota, and put into the Mississippi at that point. Forty-five thousand were put in Lake Champlain, and fifty thousand in the Alleghany at Salamanca. The most interesting experiment was the transportation of the fry to California. This was undertaken at the expense of the commissioners of California, but with the permission of the New York commissioners. The attempt was apparently hopeless, and nothing but failure was predicted, but it turned out to be a success, and as an account of the trial will serve as a guide for future journeys, I will insert it here.

On the 19th day of June, 1871, I started at 6 a. m. from my hatching-establishment ten miles below Albany, on the Hudson River, with twelve thousand young shad in four eight-gallon milk-cans. They had been hatched the night before at the establishment under charge of the New York commissioners. I arrived at Rochester at 10 p. m., and changed the water, substituting that from the Genesee River, without injury to the fish. I arrived at Cleveland at 7.45 next morning; put two hundred shad in Lake Erie, and changed the water again. The fish were then fresh and lively, without any signs of sickness. I again changed the water at Toledo, and when I arrived at Chicago at 7 p. m. the fish were still in good order. Here I first tried the water from the city water-works, but found there was too much oil in it; so I went to the lake. Having tasted the water and found that it would answer, I put two hundred fish in Lake Michigan, and on June 21 started with cans newly filled, at 10.45 a. m., for California. I carried an extra can of water, for before me was a long stretch of almost arid land; still I was fortunate enough to find some places between Chicago and Omaha where I could get a few pails of water and make a partial change. The fish were still in good order when we arrived at Omaha; but there I could not find any water in which they would live five minutes. The way I tested the water was by filling a tumbler and putting a few fish in it; it was easy to tell at once, by the behavior of the fry, whether the water agreed with them or not. I did not get a full change until I reached Laramie River. From Omaha I did not find any good water for four hundred miles, and the only way I kept my charges alive was by drawing the water out of the cans into pails, and pouring it from one pail into another until purified; this process being assisted by my getting a little ice-water from the car-tanks.

June 22.—Bad water all day, with the thermometer 100° in the shade from 9 a. m. to 4 p. m. I used ice-water the entire day, a very little at a time, and had hard work to keep the temperature of the water below 82°. I began to feel blue, and doubtful of the result. The fish suffered considerably, but the weather began to be cold toward night, and I got the temperature of the water down to 75° at 9 p. m., the fish recovering a little.

June 23.—I arrived at Laramie River at 5 p. m. and got a good change of water; fish doing well, and I began once more to feel hopeful and encouraged. We had a frost that night, and next morning at 7 I changed water at Green River, where it was in proper condition. At 2 p. m. I got another change from a stream in which there were trout, and again at Ogden, where I put two hundred fish in the river.

June 25.—The water was changed at the Humboldt River; the water was good and continued good all the rest of the way.

June 26.—I arrived at Sacramento and took the fish up the river two hundred and seventy-five miles from Sacramento, in company with

Messrs. Redding and Smith, the California fishery commissioners. In their presence I deposited the fish in the Sacramento River the same night at 10 p. m.; there were about ten thousand in good order. On the sixth and seventh days out they began to be very busy looking for food. Whenever I changed the water they would clean up all the food there was in it in five minutes. They did not suffer for food as long as the sack lasted on their bellies; that is about five days; then they needed sustenance. If I could get a change of water often enough from running streams I could carry them a long way, as nearly all streams are filled with small insects. With this view I examined the water of the Sacramento where I put them in, and found plenty of food for the young fry. I then went down to the Pacific Ocean and found that there were plenty of sand-fleas, which are the principal food of the old shad in the Atlantic. And now I can only say that if they do not have shad in the Pacific Ocean there will be but one cause, the roily water, caused by washing the mountains down for gold. However, I think the fish will get through all right.

In closing this article I cannot do better than quote from a late speech of the Hon. Robert B. Roosevelt in the House of Representatives:

> The relative fertility of the water and the land is altogether in favor of the water. An acre of land will produce corn enough to support a human being, but an acre of water will produce enough to support several persons, and could readily be made, with proper aid, to sustain the lives of many more. The former requires manuring, working, planting, and harvesting; the latter merely requires harvesting; and that, where the fish are sufficiently abundant, is hardly a labor at all. While the yield from the land is reasonably large, the profit is exceedingly small. The field must be plowed and harrowed and fertilized; the corn must be planted; it must be plowed again; and still again must be hoed; and at last the ears must be stripped, husked, and ground. What is the net result of this, compared with the natural increase of fish grown in abundance, almost without effort, finding their own food, and finally taken in some net, which does its own fishing while its owner is sleeping?
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> * * * * * Fish neglected, destroyed, poached, and wasted can soon be annihilated. Their reproductive power can only maintain a certain equilibrium; incline that toward destruction, and the entire class will quickly disappear. Treat them like wild animals and they will inevitably be exterminated; domesticate them, as it were, encourage their growth by putting them under healthful influences, protect them from unseasonable disturbance, let them breed in peace, guard the young from injury, assist them by artificial aid, select the best varieties for appropriate waters, and we will soon augment the supply as greatly as we do with either land-animals or vegetables.

A HUNDRED YEARS' PROGRESS.

BY CHARLES L. FLINT.

The Centennial Exhibition, to be held in the city of Philadelphia in the year 1876, is to be a memorial of the struggles, the sacrifices, the heroic endurance, and the triumphs of our fathers in founding a free government, claimed to be the highest type of civil polity which the world has ever seen. As the time draws nigh, this grand occasion appeals to the pride, to the patriotism, to the reverence for the past, to the memory of the dead, to the highest and most unselfish feelings of every American heart, to make it a success, and, beyond all question, the grandest event of the kind which mankind has ever beheld. Anything short of this will fail of its purpose.

It is true the happiness and prosperity of a nation depend upon the union and the harmonious development of every variety of industrial pursuit; but the groundwork and the pillar of civilized society, on which its prosperity, its solidity, and its glory must ultimately rest, is agriculture, the production of the means of sustaining a rapidly growing population. Commerce draws its life-blood from this, manufactures grow out of it. "They all stand together, like pillars in a cluster, the largest in the center, and that largest is agriculture."

A glance at the history of this great industry in the United States will therefore be found to possess much that is interesting, instructive, and useful.

There is little need to look beyond the period of the Revolution in search of the first steps at any real progress in the agriculture of this country. The first European settlers upon these shores had to begin life anew, as it were, in the midst of untold hardships, privations, and dangers. They found a climate widely different from any which they had known before; a soil which the foot of civilized man had never trod, and natural productions which they had never seen. They brought with them little or no experience which could have fitted them for the rude struggle with nature in which they were about to engage. This they were forced to gain, painfully and laboriously enough, with the ax in hand to clear the forest, and the gun by their side to defend their lives. That progress in agriculture should have been slow is not, therefore, a matter of surprise. We must rather wonder that they got on at all in the struggle for life.

The different colonies, no doubt, had a somewhat different experience. The winters of Virginia were milder than those of New England, and the settlers on the James River suffered less from this cause than those farther north, but all were alike surrounded by a wilderness infested by savage men and by wild beasts, always ready to prey upon their live stock or to destroy their crops. For some months after landing there were, indeed, no cattle to be destroyed. The first animals imported into the colonies were those that arrived at the James River plantation, some time previous to 1609, the exact date of their arrival not being known. In 1610 several cows were landed there, and a hundred more in 1611. The first may have been brought by the early adventurers, either at the time of their first voyage, in 1607, or soon after, but the later additions probably came from the West Indies, being the descendants of the cattle brought to America, in his second voyage, by Columbus, in 1493.

So important was it considered that the cattle should be allowed to increase and multiply that, according to an old authority, an order was passed forbidding the destruction of domestic animals, on pain of death to the principal, burning of the hand and cropping the ears of the accessory, and a sound whipping for the concealer of the facts. Such being the nature of the encouragement to the raising of stock, the number of cattle in the Virginia colony increased to about five hundred head in 1620, and to about thirty thousand in 1639, while the fact that the number had decreased to twenty thousand in 1648, would seem to indicate that the restriction had been removed. Many also had been sent to the colonies farther north.

The first cattle that were brought to New England arrived at Plymouth in 1624, in the ship Charity. They were imported for the colony by Governor Winslow, and consisted of three heifers and a bull. They possessed no uniformity of color, being black, black and white, and brindle. In 1626 twelve cows were sent to Cape Ann, and in 1629 thirty

more, while in 1630 about a hundred were imported for the "governor and company of the Massachusetts Bay in New England." In the mean time a hundred and three cattle and horses were imported into New York from the island of Texel, Holland, by the Dutch West India Company; and in 1627, the settlements along the Delaware were supplied by the Swedish West India Company, so that by the year 1630 the number of horned cattle in all the colonies must have risen, by importations and by natural increase, to several thousands, to which were added in 1631, 1632, and 1633 many large yellow cattle from Denmark, brought over by Captain John Mason, who was engaged in extensive lumbering operations along the Piscataqua River, in New Hampshire.

These were the sources from which the common or "native" cattle of this country sprang. The earlier importations were undoubtedly more extensive than any subsequent ones, the colonists relying upon the natural increase to supply their wants, but there is historical evidence to show that there was more or less interchange of stock between the various colonies at an early date, and that this resulted in a mixture of blood, such as we find it now in our common stock.

We are to bear in mind, also, that the stock of the mother-country and of the various other countries from which the supplies of the colonists were drawn was not at that time improved as we find it in the present day. It was long before the interest in the improvement of stock had been awakened, and it is a historical fact that the ox of that day was small and ill-shaped, quite inferior to the ox of our own time; that the sheep has undergone a vast improvement, both in the fineness and value of its wool and the size and quality of the carcass, within the last century; that throughout the earlier part of the last century the average gross weight of the neat cattle sent for sale to the Smithfield market did not exceed three hundred and seventy pounds, and that of sheep twenty-eight pounds, while the average weight of the former is now over eight hundred pounds, and of the latter over eighty pounds. Nor is it probable on account of the high price of cattle at that period, and the risks to which they were to be exposed, that the colonists obtained the best specimens then known. In fact the difference in animals, and what are now considered the best points and the highest indications of improvement, were nowhere understood or appreciated two centuries ago. That the cattle of the early settlers were poor of their kind, as compared with our ideas of the quality of similar animals, is, therefore, plain enough to be understood.

In addition to this, the means of keeping stock of any kind, in such a manner as to secure any improvement in it, were not at hand. The early colonists had no notion of raising grass and hay for their animals by artificial means. They relied chiefly, and almost from necessity, upon the production of natural meadows and the grasses upon the salt-marshes along the sea-shore. The cattle, like their owners, had to browse for their lives, and through the long northern winters to live on poor and miserable swale-hay. Death from starvation and exposure was not uncommon, and sometimes an entire herd fell victims to the severity of the season. The most terrible droughts were of frequent occurrence, and caused great distress. The Indian corn and the grasses perished to such an extent that both grain and forage for stock, at times, had to be imported from England, to keep the people from starving, and to keep the cattle alive, even so late as 1750.

Of the mode of keeping cattle in the Virginia colony, Glover, a contemporary, as appears by the Historical Register, says: "All the inhabitants give their cattle in winter is only the husks of their Indian

corn, unless it be some of them that have a little wheat-straw, neither do they give them any more of these than will serve to keep them alive; by reason whereof they venture into the marshy grounds and swamps for food, where very many are lost." And Clayton, another contemporary authority, says that "they neither housed nor milked their cows in winter, *having a notion that it would kill them.*" A still later Swedish traveler, Kalm, in speaking of the James River colony, in 1749, says:

They make scarce any manure for their corn-fields, but when one piece of ground has been exhausted by continual cropping they clear and cultivate another piece of fresh land, and when that is exhausted proceed to a third. Their cattle are allowed to wander through the woods and uncultivated grounds, where they are half starved, having long ago extirpated all the annual grasses by cropping them too early in the spring, before they had time to form their flowers or to shed their seeds.

This statement will apply with nearly equal force to the other colonies at that date. That the description is strictly correct, I may quote from a distinguished Virginian, the Hon. James M. Garnett, who, in 1842, said:

Previous to our revolutionary war, as I have been told by the farmers of that day, no attempts worth mentioning were made to collect manure for general purposes, all that was deemed needful being saved for the gardens and tobacco-lots, by summer cow-pens. These were filled with cattle such as our modern breeders would hardly recognize as belonging to the bovine species. In those days they were so utterly neglected that it was quite common for the multitudes starved to death every winter to supply hides enough for shoeing the negroes on every farm. This was a matter so generally and constantly anticipated, that my own grandfather, as I have heard from unquestionable authority, was once very near turning off a good overseer because cattle enough had not died on the farm of which he had the supervision to furnish leather for the above purpose. When any cattle were fattened for beef, almost the only process was to turn them into the corn-fields to feed themselves. Sheep and hogs were equally neglected.

In order to realize still more fully the condition of the early settlers, so far as the treatment of stock is concerned, we are to consider that no attention was paid to the culture of the grasses, even in England, in the early part of the seventeenth-century, and that very few of the roots now extensively cultivated and used as food for stock had been introduced there. The introduction of red clover into England did not take place till 1633; that of sainfoin, not till 1651; that of yellow clover, not till 1659; that of the white or Dutch clover, not till 1700. Of the natural grasses, our well-known timothy was first brought into cultivation in this country, and it was not cultivated in England until the year 1760. The culture of orchard-grass was first introduced into England from Virginia in 1764. There is no evidence of any systematic or artificial cultivation of grasses there until the introduction of the perennial rye-grass in 1677, and no other variety of grass-seed appears to have been sown for many years, not, indeed, till toward the close of the last century, upon the introduction of timothy and orchard-grass. The Edinburgh Quarterly Journal of Agriculture, the highest authority in such matters, says the practice of sowing grass-seed was never known in Scotland previous to the year 1792. Such being the case, in a climate so severe as that of Scotland, it is not at all surprising that the custom in this country dates back only about a hundred years.

It is a somewhat curious fact that the modern improvement in cattle in England did not begin till after the systematic culture of the higher qualities of natural grass. It is not strange, therefore, that the colonists here, who had vastly greater hardships to encounter in the practical operations of the farm, were slow to recognize the possibilities of improvement, or that their cattle, poor as they must have been at the outset, continued rather to depreciate than to improve in quality until

some time after the Revolution. The numbers increased, however, as the range of pasturage or browsing-grounds was comparatively unlimited, so that the keeping of stock may be said to have assumed some importance in the older settlements, by the middle of the last century, when it had become comparatively safe from molestation.

One of the chief obstacles the early colonists had to encounter, to add to the hardships of their lot in the cultivation of the soil, was the difficulty of procuring suitable implements. A few, no doubt, were brought with them, but all could not obtain them in this way, and the only metal they had was made of bog-ore, and that was so brittle as to break easily and put a stop to their day's work. Most of their tools were made of wood, rude enough in construction, heavy of necessity, and little fit for the purpose for which they were made. The process of casting steel was then unknown. It was discovered in Sheffield, England, but not till the middle of the last century, and then kept a secret there for some years. The few rude farming-tools they had were, for the most part, of home manufacture, or made by the neighboring blacksmith as a part of his multifarious business, there being little idea of the division of labor, and no machinery by which any particular implement could be exactly duplicated.

But it is recorded that as early as 1617 some plows were set to work in the Virginia colony, for in that year the governor complained to the company that the colony "did suffer for want of skillful husbandmen and means to set their plows on work; having as good ground as any man can desire, and about forty bulls and oxen, but they wanted men to bring them to labor, and iron for the plows, and harness for the cattle. Some thirty or forty acres we had sown with one plow, but it stood so long on the ground before it was reaped it was most shaken, and the rest spoiled with the cattle and rats in the barn." A contemporary resident of that colony says, in 1648, "We have now going near upon a hundred and fifty plows," and they were drawn by oxen. In 1637 there were but thirty-seven plows in the colony of Massachusetts Bay, and for twelve years after the landing of the Pilgrims the farmers had no plows, but were compelled to tear up the bushes with their hands, or with clumsy hoes and mattocks. It afterwards became the custom, in the Massachusetts colony, for some one owning a plow to go about and do the plowing for the farmers over a considerable extent of territory, and a town sometimes paid a bounty to any one who would keep a plow in repair for the purpose of going about to work in this way. The massive old wooden plow required a strong team, a stout man to bear on, another to hold, and a third to drive. The work it did was slow and laborious. The other tools were a heavy spade, a clumsy wooden fork, and, later, a harrow. I have had in my possession specimens of these forks two hundred years old. It is difficult to see how they could have done very effective work.

The plows used by the French settlers upon the "American bottom," in Illinois, from the time of their occupation, in 1682, down to the war of 1812, were made of wood, with a small point of iron fastened upon the wood by strips of rawhide. The beams rested upon an axle and small wooden wheels. They were drawn by oxen yoked by the horns, the yokes being straight and fastened to the horns by raw-leather straps, a pole extending back from the yoke to the axle. These plows were large and clumsy, and no small plow was in use among them to plow among corn till about the year 1815. They used carts that had not a particle of iron about them.

Among the forms of the old wooden plow that achieved something

more than a local reputation during the last century was that known as the "Carey plow." It was more extensively used than any other, though its particular form varied very much according to the skill of each blacksmith or wheelwright who made it. The land-side and the standard were made of wood, and it had a wooden mold-board, often roughly plated over with pieces of old saw-plate, tin, or sheet-iron. It had a clumsy wrought-iron share, while the handles were upright, held in place by two wooden pins. It took a strong man to hold it, and about double the strength of team now required to do the same amount of work. The "bar-share plow," sometimes called the "bull-plow," was also used. A flat bar forming the land-side, with an immense clump of iron, shaped like half of a lance-head, into the upper part of which a kind of colter was fastened, which served as a point. It had a wooden mold-board fitted to the iron-work in the most bungling manner. A sharp-pointed shovel, held with the reverse side up, and drawn forward with the point in the ground, would give an idea of its work. Then there was the "shovel-plow," in very general use in the middle and southern colonies, a roughly hewn stick was used for a beam, and into this another stick was framed, upon the end of which there was a piece of iron, shaped a little like a sharp-pointed shovel. The two rough handles were nailed or pinned to the sides of the beam. A plow known as the "hog-plow" was also used in some parts of the country in the last and the early part of the present century, so called probably on account of its rooting propensity. Specimens of this plow were taken to Canada in 1808 for use there, which would seem to indicate that it was thought to be one of the best plows then made. These old forms of the wooden plow continued to be used with little or no improvement till some time after the beginning of the present century. The wooden plow was liable to rapid decay. As for the other implements of husbandry, they were very few and very rude. The thrashing was done with the flail. The winnowing was done by the wind. Slow and laborious hand-labor for nearly all the processes of the farm was the rule, and machine-labor the exception, till a comparatively recent date. Indeed, it has been said that a strong man could have carried on his shoulders all the implements used on his farm, except, perhaps, the old wooden cart and the harrow, previous to the beginning of the present century, and we know that the number as well as the variety of these tools was extremely small.

Of the crops raised by the early settlers, and upon which they relied chiefly for sustenance, Indian corn, pumpkins, squashes, potatoes, and tobacco were mostly new to them. Few Europeans had ever seen them cultivated previous to their arrival here, but necessity soon showed their value and from the Indians they learned how to grow them. It was a method followed with little change down to the opening of the present century. It was to dig small holes in the ground about four feet apart, put in a fish or two, drop the seed, four or six kernels of corn, and cover it up. The instrument used by the Indians for this purpose was made of a large clam-shell, but the colonists soon substituted the heavy mattock or grub-hoe. The James River settlers, under the tuition of the Indians, began to raise corn in 1608, and within three years after they appear to have had as many as thirty acres under cultivation. The pilgrims found it in cultivation by the Indians on their arrival at Plymouth, and began its culture in 1621, manuring, as the Indians did, with alewives, then called "shads." An early chronicle of the Pilgrims says, "According to the manner of the Indians, we manured our ground with herrings, or rather shads, which we have in great abundance and take with great ease at

our doors." And later: "You may see in one township a hundred acres together set with these fish, every acre taking a thousand of them; and an acre thus dressed will produce and yield so much corn as three acres without fish." In 1623 the drought was so severe and long protracted that the corn, planted very shallow and manured with these fish in the hill, soon began to wither and curl up, and on the higher lands it was ruined. And so in many years succeeding.

Wheat was first sown by Goswold on Cuttyhunk, one of the Elizabeth Islands, in Buzzard's Bay, as early as 1602, when he first explored the coast. In Virginia the first wheat appears to have been sown in 1611, and its culture continued to increase there till, in 1648, it is recorded that there were several hundred acres of it. But it soon after fell into great disrepute as a staple crop, as the culture of tobacco was found to pay a great deal better. For more than a hundred years after it was but little cultivated in that colony. Wheat was early cultivated by the Dutch colony of the New Netherlands, for it is recorded that in 1626 samples of this grain were taken to Holland to show what could be done in the new country. It is probable that the Plymouth colony began its culture within two or three years of the settlement, though there appears to be no distinct record of it until 1629, when wheat and other grains for seed were ordered from England.

But though the cultivation of wheat was begun almost simultaneously with the settlement of the several colonies, it did not attract very great attention for more than a century, Indian corn and, later, potatoes being relied upon for food to a much greater extent. It was soon found to be subject to blast and mildew in the eastern colonies. In July of 1663, "the best wheat," according to an old manuscript diary that I have consulted, "as also some other grain, was blasted in many places so that whole acres were not worth reaping. We have had much drought the last summer, and excess of wet several other springs, but this of blasting is the first so general and remarkable that I yet heard of in New England." But it was "heard of" often after that, and to such an extent that it never became a very prominent crop in that part of the country. It is a matter of history that there never was a time in the eastern colonies when it was a sure and reliable crop, unless it be so now with our improved modes of culture and our better knowledge of the proper modes of tillage, deep plowing, and thorough drainage.

Rye and barley were also introduced and cultivated by the early settlers, and it soon became the almost universal practice to mix the meal of the former with Indian meal in the making of bread. It is known to have been the custom as early as 1648, and probably it began at a considerably earlier date, perhaps as early as 1630. Oats were also introduced at the same time with rye. Captain Goswold raised them with other grains on one of the Elizabeth Islands, on the southern coast of Massachusetts, in 1602. Though much more extensively grown than rye, they appear to have been used chiefly as food for animals. The practice of sowing grass-seed, as we have seen, never became common in the colonies. It was not generally adopted till about the time of the Revolution, though here and there an individual farmer may have tried to see what he could do to help nature clothe the surface of his old fields, but any general or systematic attempt to cultivate grasses for hay was wholly unknown and unthought of. This culture was of recent origin in this as well as in the mother-country, and is the result of modern improvement in agriculture.

The culture of the potato, though introduced early in the history of the colonies, being among the seed ordered for the Plymouth Colony as

early as 1629, was not recognized as a very important and indispensable crop till about the middle of the last century, when it had come to be widely known and esteemed as an article of food, for we know that in 1747 about seven hundred bushels were exported from South Carolina. It was the sweet-potato that first came to be regarded as a delicacy in England, and the allusions of some rather early English writers undoubtedly refer to this, rather than the common potato.

Very little attention was paid to the raising of fruits previous to the Revolution, except for the manufacture of cider. The first apples were raised upon Governor's Island, in the harbor of Boston, from which, on the 10th of October, 1639, "ten fair pippens were brought, there being not one apple or pear tree planted in any part of the country but upon that island." The first nursery of young trees in this country was that planted by Governor Endicott on his farm at Salem, now Danvers, in 1640, and it is related that he sold five hundred apple-trees for two hundred and fifty acres of land. The systematic cultivation of fruit was not common in this country previous to the Revolution, nor did it become so till within the last fifty years. Orchards were set out upon many farms, but they were designed chiefly for cider. Much greater care, however, was taken to raise good fruits in New York, New Jersey, and Pennsylvania than in New England, and several noted orchards and nurseries existed there in the latter part of the last century and the early part of the present, but they were the exception to the general rule even there. Choice varieties of apples, pears, peaches, and cherries were known only to a few careful cultivators, and the number of varieties of these was quite limited as compared with the present day. Cider was plenty, but its quality was much less regarded than its quantity. It is stated that so late as 1825 there was not a nursery for the sale of apple and pear trees in New England. Trees had to be bought in New York or New Jersey, or imported from abroad. The first horticultural society in the country was established in 1829. The orchard products, according to the last census, have now risen to $48,000,000, and the general culture of fruit is rapidly progressing.

We are now prepared to appreciate the condition of our agriculture at the time of the outbreak of the Revolution. We have seen that the settlers had but poor and inefficient tools, poor and profitless cattle, poor and meager crops, and poor and miserable ideas of farming. They had no agricultural journals, no newspapers of any kind, and few books, except the old family Bible. There were less than a dozen papers published in the country at the middle of the last century. There was not one in New England at the beginning of that century, but four in 1750, and these had but a very limited circulation in the rural districts. There was little communication from town to town. The facilities for travel were extremely limited. It was before the days of stages even, and the liberalizing influence which modern travel and social intercourse exert. Everything was favorable to the growth of prejudice and of narrow-minded views.

Moreover, it is to be considered that throughout all the days of the colonies, from the very outset, the policy of the home-government was to make the provinces a source of profit to the mother-country. It was a rigorous rule that all manufactured articles were to be procured of England. The colonies were not allowed to produce such articles for themselves, or to do anything which should come in conflict with the industry of the old country. But if there were any articles that England was in need of, the industry of the settlers was confined to them, and they could sell them only to England and buy what

they required only of her. They encountered new restrictions at every turn. The grants or charters were issued, in some cases to individuals, in others to companies, and this involved, and it was clearly understood to involve, self-government; but the home-government very soon began to claim the right and the power of confirming the several governors. The colonists were forbidden even to cut down pine-trees on any pretense. They were denied the right to export wool to any place out of the King's dominions, to sell land to anybody except subjects of the British Crown, to ship any produce except in English vessels, to coin money, to do anything, in fact, which could lessen their dependence upon the mother-country. Every new step taken, even in settling and working new lands, was met by some new and burdensome restraint, intended to keep the colonists in leading-strings. A formal act of Parliament, passed soon after the beginning of the last century, denied the right of the colonists to make hats. The home-government was very indignant at the custom which the people had of working up their wool and flax into home-spun cloth. They were forbidden to manufacture ore beyond the state of pig-iron. Thus the most oppressive restrictions bore upon colonial agriculture, as well as upon colonial commerce and manufactures, from the very outset of the settlements. They finally became so burdensome as no longer to be endured with patience, and led to an open rupture with the home-government, commonly known as the Revolution, at a time when the population of the whole country was considerably less than three millions, the general and popular estimate of three millions being altogether too high.

During the period of the Revolution farm production was brought to a partial stand-still, and, for some years after, it was in a state of extreme depression. It took time to recover from the effects of the struggle. Gradually, however, the importance of some effort to develop and improve the agriculture of the country was impressed upon the minds of the more intelligent and public-spirited of the people, men, for the most part, who were in advance of their time. The result of their deliberations was the formation of societies for the encouragement of agricultural improvement. Thus the South Carolina Agricultural Society was established in 1784; the Philadelphia Society for Promoting Agriculture, in 1785; the New York (city) Society, in 1791; the Massachusetts Society for Promoting Agriculture, in 1792. These were rather city than country institutions. They were very slow in reaching the common people. The average farmer of that day was not up to their standard of thought and observation. Their example, their teachings, their entreaties for aid, their reports and papers, fell comparatively dead upon the mass of the people. Farmers were not to be taught by men who never held the plow. They did not want anything to do with *theories*. Custom had marked out a road for them, and it was smooth and easy to travel, and, though it might be a circle that brought up just where it had started, it had the advantage, in the old farmer's mind, that in it he never lost his way. It didn't require any exertion of mind. His comfort, as well as his happiness, was based on a feeling of filial obedience to old usage that was hereditary in his being. It was born in the blood, and ruled him with an irresistible power. His field of vision was bounded and narrow, and his work was strictly *imitative*, so far as he could see, and in no way *experimental*. The old common law, based on precedent, custom, practice, was his guide and his rule. He would be governed by custom, not by reason. If ancient custom was *known*, that was good enough for him. It wasn't for him to doubt. To investigate would imply doubt. To investigate was to

theorize. Theory is at the bottom of all investigation, and theory was a bugbear in his mind. The logical result—that no improvement could be reached without investigation—had no terrors for him. He seldom read. The *written* word he received with distrust. It might contain principles, and it wasn't principles that he cared anything about, but *practice*. No matter whether founded on wisdom and experience or not, practice was the thing.

It is probable that the events and the excitements of the Revolution itself, with the travel, the observation, and the social intercourse which it involved, had much to do with breaking up the impregnable barrier of prejudice and slavery to custom and precedent which ruled so strongly in the popular mind. Great passions which reach and stir up the lowest depths of the nation's heart have a liberalizing and progressive influence. They excite thought and awaken a spirit of inquiry. But that the picture is not in the least overdrawn is evident from the fact that here and there are a few specimens left to remind us that the leaven which the early societies infused among the people has not yet permeated the entire mass.

But time brings its changes. Something more was felt to be needed, and a convention was held in Georgetown, in the District of Columbia, on the 28th of November, 1809, from which grew the Columbian Agricultural Society for the Promotion of Rural and Domestic Economy; and the first exhibition, probably, in this country, was held by that society on the 10th of May, 1810, with the offer of liberal premiums for the encouragement of sheep-raising, &c. Elkanah Watson exhibited three merino sheep in Pittsfield, Massachusetts, in the October following of the same year. It was an innovation upon old custom, and the occasion of much ridicule and contempt among the farmers of that day and generation, but it was the germ of the Berkshire County Agricultural Society, whose regular exhibitions began the year following, and are believed to have been the first county exhibitions ever instituted in this country.

The Massachusetts Society held its first exhibition at Brighton in 1816, offered a list of premiums, and instituted a plowing-match; but it appears to have been rather with the design of testing the strength, training, and docility of the oxen than to improve the plow. The plow-maker, however, happened to be there with his eyes open, and there can be no doubt that this and similar exhibitions which soon followed gave a new impetus to the progress of agricultural mechanics. Improvements in the plow had begun, even before the close of the last century. A patent had been granted for a cast-iron plow to Charles Newbold, of Burlington, New Jersey, in 1797, combining the mold-board, share, and land-side, all cast together, and it was regarded by intelligent plow-makers as so great an improvement that Peacock, in his patent of 1807, paid the original inventor the sum of $500 for the right to combine certain parts of Newbold's plow with his own. The importance of this implement was so great as to command the attention and study of scientific men, to improve its form and construction, and Thomas Jefferson, in 1798, applied himself to the task, and wrote a treatise upon the requisite form of the mold-board, according to scientific principles, calculating the exact form and size, and especially the curvature to lessen the friction. I have in my possession his original manuscript of this essay, containing his drawings and calculations.

But these changes and improvements were not readily adopted by the farming community. Their introduction was far slower than any

new invention that promised to economize labor and do better work would be at the present day. Many a farmer clung to his old wooden plow, asserting that cast iron poisoned the ground and spoiled the crops. He required an ocular demonstration before paying his money for an iron plow. It was not so much the weight of the old plow as the form of the mold-board, and the construction of the various parts, that needed correction. Its draught was great, on account of the excessive friction. The share and mold-board were so attached as to make too blunt a wedge. Its action was not uniform, and it was difficult to hold, requiring constant watchfulness and great strength to prevent it from being thrown out of the ground. To plow to any considerable depth it was necessary to have a man at the beam to bear down. The mold-board was often shod with iron to lessen the friction and prevent wear, but it was usually in strips, often of uneven thickness, so that the desired effect was not always attained. The cast-iron plow remedied these serious defects, and secured at least some greater uniformity in construction. The modifications of the mold-board, which resulted from a better understanding of the true principles of construction, have enabled the farmer to do vastly better work, and a greater amount of it in the same time, and at a less expenditure of strength, and to reap larger crops as the result of his labor, while the cost of the implement, considering its greater efficiency and its durability, is less by half, probably, than the old wooden plow.

There can be no doubt that the saving to the country from these improvements in the plow, within the last half century, amounts to many millions of dollars a year in the cost of teams, and some millions in the cost of plows, or that the aggregate of crops has been increased by them many millions of bushels. The plow has also been modified to adapt it to a much greater variety of soils. In the mode of manufacture, too, a vast improvement has taken place. Half a century ago it was made sometimes on the farm, sometimes by the village blacksmith, and the wheelwright. The work is now concentrated in fewer establishments, which make it a specialty. In Massachusetts, for example, in 1845, there were seventy-three plow-manufactories, making 61,334 plows and other instruments annually, while in 1855 the number of establishments had decreased to twenty-two, which made 152,686 plows, valued at $707,175.86, annually. A very large plow-factory was established in Pittsburgh, Pennsylvania, in 1829, and, as early as 1836, it was manufacturing as many as a hundred plows a day, by the aid of steam-power, to supply chiefly the southern market. This establishment first made a hill-side revolving-beam plow, and the iron-center plow, and more recently it has made a vast number of steel plows, adapted to the prairie soils of the West. Another factory, in the same city, as early as 1836, made plows at the average rate of 4,000 a year. The two factories made 34,000 plows a year, valued at $174,000. There are now many other still larger factories, some of which make from ten to twelve hundred different patterns, adapted to every variety of soil and circumstance.

No one can for a moment doubt the vast superiority of the best of the plows of the present day over the old forms in common use half a century ago. They have greater pulverizing power; they are less liable to clog; while in lightness of draught, ease of holding, durability, cheapness, perfection of mechanical work, quality of material, completeness with which the surface is inverted and the weeds or stubble buried, uniformity of wear, regularity of turning the furrow-slice, and other respects, we have made a vast and unquestionable improvement. In

short, mechanical principles are better understood and more intelligently applied. We have combined simplicity of construction with economy of power. A better knowledge of the strength of materials has enabled us to reduce the size of all the parts of farming-tools, and so to avoid the clumsiness of the older style of implements, and, at the same time, to secure much more effective work. We have made some progress, also, in substituting the principle of the spade, or the fork, for that of the plow, as the use of the rotary spader is a sufficient proof. We have made some progress in the application of steam to the operation of plowing, and the wonderful performances of the steam-plow, in the few instances where it has been tried, have indicated the possibilities of the future, and shown that the time is not far distant when we shall have it in our power to develop the resources of the great West to an extent and with an economy never yet dreamed of.

The importance of a complete and perfect pulverization of the soil, to admit of the extension of the roots of plants, and the access of air and moisture, was never more fully realized than at the present time. As it is at best but partially effected by the plow, which crumbles and breaks down the soil simply in the process of turning, something farther has always been required, and the harrow has been used for this purpose, to follow the plow, from time immemorial. With the early settlers this implement, like most others, was made of wood, of simple bars and cross-bars, furnished with wooden teeth. It was usually home-made, rude and clumsy enough. The first improvement was the substitution of iron for wooden teeth, which were afterward pointed with steel, when it was made lighter, so as to admit of being moved more rapidly through the soil.

The changes and improvements of this implement came very slowly, and it is scarcely twenty years since it can be said to have approached perfection. It has now assumed a more compact form and greater flexibility, certain parts of the frame-work being hinged together, so that any part can be lifted or raised without disturbing the working of the rest, while particular forms have been made for special purposes, like the Share and the Nishwitz, admirably adapted to mellowing the surface of newly-broken land without tearing up the inverted sod. The rotary and the smoothing harrow may be mentioned, also, as a vast improvement upon the old styles. These and many other patterns, after which the harrow is now made, seem to leave little to desire in the form and efficiency of this most important implement.

A large class of the most valuable labor-saving implements may be mentioned which are almost entirely due to modern ingenuity, such as the cultivators, the horse-hoes, the grubbers, the drills and seed-sowers, and others of a similar character. By means of the horse-hoe and the cultivator the soil can be frequently stirred among growing crops, at a slight expense, thus enabling them to withstand the effects of drought, giving us, practically, a greater control over the seasons. Many of these smaller machines are wonderfully perfect and well adapted to the purpose for which they are constructed. And while mechanical invention has been active in this direction, our shovels, spades, hoes, and forks have been vastly improved and made more effective, till, for lightness and finish, in combination with strength and durability, they are unsurpassed by any similar tools in any part of the world; while the rapidity with which they can be manufactured, and the consequent cheapness with which they are sold, are among the marvels of modern mechanics.

The manufacture of these important articles was undertaken, to be sure, even before the Revolution, and as early as 1788 the iron-plated

shovels made in Bridgewater, Massachusetts, gained the credit of being superior in workmanship to the best imported shovels of that day, and they undersold them at the same time. A large shovel-factory was established at Easton, Massachusetts, about seventy years ago, and as early as 1822 it was making about 30,000 shovels a year. By improvements in the process of manufacture, the patents for which were issued in 1827, the proprietor gained so high a reputation and such an increase of business, that by 1835 he was making about forty dozen shovels and spades per day, each shovel, in the systematic division of labor, passing through the hands of no less than twenty different workmen. The same establishment can now produce over two hundred and fifty dozen a day. Cast-steel shovels were first patented in 1828, but cast-steel hoes were made by two different establishments in Philadelphia as early as 1823. Shovels and hoes were made at Pittsburgh, Pennsylvania, in considerable quantities previous to the year 1803, and by the year 1831 steel hoes were made there so as to be sold at the rate of $4.50 a dozen, only half the price of the iron hoe ten years earlier. Two factories in that city, in 1836, were able to make steel hoes at the rate of 1,600 dozen, besides 8,000 dozen shovels and spades a year, in addition to a large quantity of other tools; while, in 1857, four large establishments there made 32,000 dozen hoes and 11,000 dozen planters' hoes, a half million dollars' worth of axes, and large quantities of picks, mattocks, saws, &c. These facts are alluded to simply to show how this industry has become concentrated in large establishments, where perfection can be attained by the division of labor. There are many similar establishments in various parts of the country.

But, perhaps, the most important of modern agricultural inventions are the grain-harvesters, the reapers, the mowers, the thrashers, and the horse-rakes. The sickle, which was in almost universal use till within a very recent date, is undoubtedly one of the most ancient of all our farming implements. Reaping by the use of it was always slow and laborious, while from the fact that many of our grains would ripen at the same time, there was a liability to loss before they could be gathered, and practically there was a vastly greater loss from this cause than there is at the present time. It is not, therefore, too much to say that the successful introduction of the reaper into the grain-fields of this country has added many millions of dollars to the value of our annual harvests, by enabling us to secure the whole product, and by making it possible for the farmer to increase the area of his wheat-fields, with a certainty of being able to gather the crop. Nothing was more surprising to the mercantile community of Europe than the fact that we could continue to export such vast quantities of wheat and other breadstuffs through the midst of the late rebellion, with a million or two of able-bodied men in arms. The secret of it was the general use of farm-machinery. The number of two-horse reapers in operation throughout the country, in the harvest of 1861, performed an amount of work equal to about a million of men. The result was that our capacity for farm production was not materially disturbed.

The credit of the practical application of the principles involved in this class of machines undoubtedly belongs to our own ingenious mechanics; for though somewhat similar machines were invented in England and Scotland many years ago, they had never been proved to be efficient on the field, and had never gained the confidence of the farmers, even in their neighborhood; while the patent issued to Obed Hussey, of Cincinnati, in 1833, and another issued to McCormick, of Virginia, in 1834, not only succeeded in the trials to which they were subjected, but

gained a wide and permanent reputation. Many patents had been issued in this country previously, the first having been as early as 1803, but they had not proved successful. Hussey's machine was introduced into New York and Illinois in 1834, into Missouri in 1835, into Pennsylvania in 1837, and in the next year the inventor established himself in Baltimore, McCormick's machine had been worked as early as 1831, but it was afterwards greatly improved, and became a source of an immense fortune to the inventor. He took out a second patent in 1845, fifteen other machines having been patented after the date of his first papers, including that of the Ketchum, in 1844, which gained a wide reputation.

The first trial of reapers, partaking of a national character, was held under the auspices of the Ohio State Board of Agriculture in 1852, when twelve different machines and several different mowers were entered for competition. There was no striking superiority, according to the report of the judges, in any of the machines. A trial had been held at the show of the New York State Agricultural Society, at Buffalo, in 1848, but the large body of farmers who had witnessed it were not prepared to admit that the work of the machines was good enough to be tolerated in comparison with the hand-scythe. Some thought they might possibly work in straight, coarse grass, but in finer grasses they were sure to clog. The same society instituted a trial of reapers and mowers at Geneva in 1852, when nine machines competed as reapers and seven as mowers. Only two or three of the latter were capable of equaling the common scythe in the quality of work they did, and not one of them all, when brought to a stand in the grass, could start again without backing to get up speed. All the machines had a heavy side-draught, some of them to such an extent as to wear seriously on the team. None of them could turn about readily within a reasonable space, and all were liable to tear up the sward in the operation. The old Manning, patented in 1831, and the Ketchum machines were the only ones that were capable of doing work that was at all satisfactory. One or two of the reapers in this trial did fair work, and the judges decided that, in comparison with the hand-cradle, they showed a saving of 88¾ cents per acre. Here was some gain certainly, a little positive advance, but still most of the reapers, as well as the mowers, did very inferior work. The draught in them all was very heavy, while some of the best of them had a side-draught that was destructive to the team.

The inventive genius of the country was stimulated by these trials to an extraordinary degree of activity. Patents began to multiply rapidly. Local trials took place every year in various parts of the country to test the merits of the several machines. The great International Exposition at Paris in 1855 was an occasion not to be overlooked by an enterprising inventor, and the American machines, imperfect as they were at that time, were brought to trial there in competition with the world. The scene of this trial was on a field of oats about forty miles from Paris, each machine having about an acre to cut. Three machines were entered for the first trial, one American, one English, and a third from Algiers, all at the same time raking as well as cutting. The American machine did its work in twenty-two minutes, the English in sixty-six, and the Algerian in seventy-two.

At a subsequent trial on the same piece, three other machines were entered, of American, English, and French manufacture, when the American machine did its work in twenty-two minutes, while the two others failed. "The successful competitor on this occasion," says a French journal, "did its work in the most exquisite manner, not leaving a single stalk ungathered, and it discharged the grain in the most per-

fect shape, as if placed by hand, for the binders. It finished its piece most gloriously." The contest was finally narrowed down to three machines, all American. Two machines were afterwards converted from reapers into mowers, one making the change in one minute, the other in twenty. Both performed their task to the astonishment and satisfaction of a large concourse of spectators, and the judges could hardly restrain their enthusiasm, but cried out, "Good, good!" "Well done!" while the excitable people who looked on hurrahed for the American reaper, crying out, "That's the machine!" "That's the machine!" The report of a French agricultural journal said: "All the laurels, we are free to confess, have been gloriously won by Americans, and this achievement cannot be looked upon with indifference, as it plainly foreshadows the ultimate destiny of the New World."

Five years after the Geneva trial there was a general desire to have another on a scale of magnificence that should bring out all the prominent reapers and mowers of the country. The United States Agricultural Society accordingly instituted a national trial at Syracuse, New York, in 1857. More than forty mowers and reapers entered, and were brought to test on the field. It was soon apparent that striking improvements had been made since the meeting at Geneva. The draught had been very materially lessened in nearly all the machines, though the side-draught was still too great in some of them. Most of the machines could now cut fine and thick grass without clogging, and there was a manifest progress in them, but of the nineteen that competed as mowers, only three could start in fine grass without backing to get up speed. The well-known Buckeye, patented only the year before, won its first great triumph here, and carried off the first prize.

Every year now added to the list of new inventions and improvements. In 1859 the Wood mower was invented, and soon gained a high reputation. By the year 1864 there were no less than a hundred and eighty-seven establishments in the country devoted to the manufacture of reapers and mowers, many of them very extensive, and completely furnished with abundant power, machinery and tools of the most perfect description, while the work had become wisely and thoroughly systematized. The people directly sustained by these factories exceeded sixty thousand, while the value of their annual product exceeded $15,000,000, the number of machines amounting to one hundred thousand.

Nine years after the Syracuse trial, another exhibition of mowers and reapers, national in its character, was held at Auburn, New York, under the auspices of the New York State Society, in July, 1866. The number of mowers that entered, single and combined, was forty-four; the number of reapers, thirty; or seventy-four in all. It was plain, at a glance, that a decided improvement had taken place in workmanship and mechanical finish. The mowers were more compact, simpler in construction, lighter, and yet equally strong; they ran with less friction; the draught was easier and the machines generally were less noisy; they cut the grass better, and were capable of working over uneven surfaces. The committee say in their report:

> Those who had been present at former trials were astonished at the general perfection which had been attained by manufacturers of mowing-machines. Every machine, with two exceptions, did good work, which would be acceptable to any farmer; and the appearance of the whole meadow, after it had been raked over, was vastly better than the average mowing of the best farmer in the State, notwithstanding the great difficulties that had to be encountered. At previous trials, very few machines could stop in the grass and start without backing for a fresh start. At the present trial every machine stopped in the grass and started again without backing, without any difficulty and without leaving any perceptible ridge to mark the place where it occurred.

We may here note the rapid progress of these most valuable labor-saving machines, for while, in the earlier trials, only one or two mowers met with any success whatever, no one doing what practical farmers could call good work, in this trial forty-two of the forty-four machines entered did their work well. In the early contests even a partial success was the rare exception; in the late, failure was the equally rare exception. In 1850 less than five thousand machines had been made and put to use, and few, if any of them, gave satisfaction. Now there is scarcely a farm of any size in the country but has its mowing-machine. It is one of the grandest agricultural inventions of modern times, and yet we see that it is less than twenty years since doubts were freely entertained as to whether it would ever become practically useful, whether the numerous mechanical obstacles would be entirely overcome. Its triumph has been complete. We have now many mowers that have not only a national but a world-wide reputation. The successful introduction of these machines was an immeasurable step in advance upon the old methods of cutting grass. They come in at a season when the work of the farm is peculiarly laborious, when labor is held at higher than the usual high rate of wages, when the weather is often fickle, either oppressively hot and trying to the physical system, or "catchy" and lowering, and they relieve the severest strain upon the muscles at the time of harvest. Our reapers are at the same time self-rakers. We can reap and gather from fifteen to twenty acres a day in the most satisfactory manner.

The horse hay-rake was invented at an earlier date than the mowing-machine. It has been used in this country nearly seventy years, and the saving by its use, sixty years ago, was estimated to be the labor of six men in the same time. The work to be performed in raking hay, though slow, is comparatively light. It does not require the exertion of a very great amount of strength. It is just such kind of work where the application of animal power becomes of the greatest advantage, because it multiplies the efficiency of the hand many times. The same thing is noticed in the use of the hand-drills for sowing small seeds, the tedder for turning and spreading hay, and in other similar operations. The labor of a good horse-rake is equal to that of eight or ten men for the same time, and from twenty to thirty acres a day can be gathered by a single horse and driver, and that without overexertion. In the economy of labor the horse-rake must be regarded as second only in importance to the mower and the reaper, and is considered as essential upon the farm as the plow itself.

The tedder is another invention of still more recent date. With the introduction of the mower, by which grass could be cut so rapidly, and the horse-rake, by which it could be gathered more rapidly than ever before, there was still wanting some means by which it could be cured proportionally quick, something to complete and round out the new system, as it were, to make the revolution of the process of hay-making entire. Various forms of the tedder had been patented and used in England, but they were too heavy and cumbersome for American use, and it was left to our own inventors to meet and overcome the mechanical obstacles in the way of success here. This they have done, and we have so far economized labor in this direction, that the tedder is now regarded as of nearly equal importance with the mower and the horse-rake.

To these appliances for lightening and shortening the labors of haying, have been added many forms of the horse-fork for unloading and mowing away hay in the barn or upon the stack. Few machines have

met with greater popular favor than the horse pitch-fork, for it saves not only the most violent strain upon the muscles, but economizes time, which, in the hurry of haying, is often of the utmost importance. The American hand-forks had been brought so near perfection, by their high finish, lightness, and strength, as to leave little to be desired, but the horse-fork has been so generally introduced as, to a considerable extent, to supersede their use.

While these vast improvements have been going on with the other implements of the farm, the improvement in machines for thrashing grain has been rapidly progressing, till they have reached a wonderful degree of perfection. Most of us can remember when the old-fashioned flail was heard upon almost every barn-floor in the country. Here and there was a case where the grain was trodden out by cattle, with an amazing waste of time and labor. Compare those slow methods with the process, widely known at the present day, by which a horse-power or steam-power thrasher not only separates the grain but winnows it, measures it, bags it, ready for market, and carries away the straw to the stack at the same operation, and all with a rapidity truly astonishing. As early as the Paris Exposition of 1855 the victory was won by an American machine. To ascertain the comparative rapidity and economy of thrashing, six men were set to work at thrashing with flails. In one hour they thrashed 36 liters of wheat. In the same time Pitt's American machine thrashed 740 liters; Clayton's English machine thrashed 410 liters; Duvoir's French machine thrashed 250 liters; Pinet's French machine thrashed 150 liters. Speaking of this trial a French journal said: "This American machine literally devoured the sheaves of wheat. The eye cannot follow the work which is effected between the entrance of the sheaves and the end of the operation. It is one of the greatest results which it is possible to attain. The impression which the spectacle produced on the Arab chiefs was profound." Good as that machine was at that time, it has been greatly improved since then; and it is a fact that wherever our first-class machines have come into competition with those of European manufacture, they have invariably proved themselves superior in point of simplicity, rapidity, and perfection of work.

Nor has the progress in the improvement of other indispensable machines of the farm been less marked and important. The smaller implements have felt the impress of the mechanical genius of the age. The corn-sheller has been brought to such perfection as to separate the corn from the ear with great rapidity, and with the application of little power. It has been adapted to horse-power also, and to different sections of country, where different varieties of corn are raised, and to shell one or two ears at the same time. Its economy of time and labor is such as, upon large farms where the product is large, to pay for itself in a single year.

The hay-cutter is another machine of modern invention. Wherever a large stock of cattle is kept, especially where a considerable number of horses are wintered, it is often thought to be good economy to feed out more or less of the coarser feeding substances of the farm, as straw, corn-stover, the poorer qualities of hay, &c., by mixing them, either with the better qualities of hay or with some sort of concentrated food, like meal. The hay-cutter is adjustable so as to cut at different lengths, according to the wants of the stock for which it is designed. The point is to cut short and with perfect regularity, and when this quality is attained in a machine, uniting strength, simplicity, durability, and safety to the operator, it is estimated that there is a gain of about 25 per cent.

in the economy of feeding, in the increase of thrift secured, and the positive advantage to be derived in the manure. There is a difference of opinion upon this point, to be sure, but notwithstanding that, the use of some form of the hay and straw cutter has become nearly universal, and is generally regarded as quite indispensable upon most well-conducted farms. Machines for this purpose are made to be worked by hand, upon small farms, and by horse or steam power upon larger ones, where they are capable of reducing to chaff a ton and a half of hay or straw per hour.

Root and vegetable cutters have been brought to equal perfection, and where large stocks of sheep and cattle are kept, and vegetables are raised for winter feeding, as they are at the present time upon all well-managed farms, the root-cutter is indispensable. By its use the farmer is now enabled to cut potatoes and other vegetables fine enough to feed to sheep, at the rate of a bushel in less than thirty seconds, by simple hand-power.

Nothing need be said of the innumerable variety of churns, hand cider-mills, the contrivances for gaining power in lifting stones and pulling stumps, ditching-machines, rollers, and a thousand other labor-saving machines which mechanical ingenuity has added to the stock of farm-tools, till the value of farming implements and machinery was reported, by the census of 1870, to be at least $336,878,429. The same was reported, in 1860, at $246,118,141, and in 1850 at only $151,587,638, a gain in twenty years of $185,290,791.

As evidence that the mechanical genius of the country is not yet exhausted, but is as untiring as ever, it may be stated that the patents issued for improvements in agricultural implements and machinery for the year 1872 exceeded one thousand, of which thirty-six were for rakes, one hundred and sixty for hay and grain harvesters and attachments, one hundred and seventy-seven for seed planters and drills, thirty for hay and straw cutters, ninety for cultivators, seventy-three for bee-hives, ninety for churns, one hundred and sixty for plows and attachments; and that the annual manufacture of agricultural implements amounts to over $52,000,000.

Having alluded briefly to the wonderful progress made in the improvement of the implements of the farm, by means of which the possibility of production has been so largely increased, let us consider for a moment the practical results attained.

Indian corn has always been regarded as the great staple crop of the country. It is a plant of American origin. In the universality of its uses, and its intrinsic importance to mankind, no other grain can be compared with it. Its flexibility of organization is such that it readily adapts itself to every variety of climate and soil, from the warmest regions of the torrid zone to the short summers of Canada. The early settlers, as we have seen, found it in cultivation by the Indians, and it soon became the leading crop throughout the country, the crop upon which the colonists relied, not only for food, but for sale and exchange for other necessaries of life. It soon became a prominent article of export, especially from the Middle States, New Jersey, Pennsylvania, and Delaware, and, to some extent, from the States farther south. Thus, in 1748, South Carolina exported 39,308 bushels, and in 1754 16,428 bushels. In 1755 there were exported from Savannah 600, and in 1770 13,598 bushels. And so, in 1753, North Carolina exported 61,580 bushels; and the exports from Virginia, before the Revolution, sometimes amounted to 600,000 bushels a year. The total amount exported from all the colonies, in 1770, was 578,349 bushels. These figures are not

large, to be sure, when compared with the immense exportation of this grain at the present day, but they serve to show that, even before the Revolution, Indian corn had come to be regarded as an important money crop, as well as a prime necessity for home consumption. They show a surplus beyond the wants of the population at that time.

Nothing will more clearly demonstrate the exceedingly slow progress of our agriculture after the Revolution than the fact that in 1791 the export of corn, including 351,695 bushels of meal, amounted to only 2,064,-936 bushels; in 1800, to only 2,032,435 bushels, including 338,108 bushels of meal, while in 1810 it fell down to 140,996 bushels, of which 86,744 bushels were in the form of Indian meal. That was before the avenues to the great West were opened. It was at a time when the inland farmer had no available market, the cost of transportation of so bulky a product making it impracticable to team it to any great distance. It was before its real value as an article of human food was appreciated in Europe, and when its consumption as such was very small. It was before our cattle had been much improved, and when their number was much smaller than it is now, when it has come to be realized that it makes our beef, our mutton, our pork, and our poultry.

Nor did the production materially increase till within the last forty years. The Erie Canal was not opened till the year 1825; nor were there any railroads to facilitate the transportation of merchandise; but the gradual extension of settlements westward after that date, and the increase of population, led to an increase of production, till, in 1840, when this crop first appears in the census, the yield had risen to 377,531,875 bushels; and from that time its increase has been quite marvelous, for in 1850 it had reached to within a small fraction of 600,000,000 bushels, or, more nearly, 592,071,104, occupying 31,000,000 acres of land. Its value was reported at that date as $296,034,552. It was a gain of 57 per cent., or 214,539,229 bushels in ten years, while the increase of population in the same time was but 35 per cent. It formed about three-sixteenths of the whole agricultural production of the country, occupied more than three-tenths of the improved land, and amounted to more than 25½ bushels for each inhabitant. The export of this grain rose in value in 1856 to nearly $9,000,000.

This wonderful rapidity of increase continued, partly on account of the vast improvement in agricultural implements and the means of raising the crop, partly on account of the multiplicity of railroads and market facilities, till, in 1860, it amounted to 838,792,742 bushels; but it had fallen off somewhat in 1870, for it is reported then as 760,944,549 bushels, a portion of the land evidently having been devoted to wheat, which had very largely increased in the same time. When it is considered that our agricultural resources are still but partially developed, the product of this cereal appears to be truly amazing.

Nor is the growth of wheat in this country less important than that of Indian corn. In some respects it is even more so. It is the brain-food of the world. It has been said that the progress of civilization and intellectual culture can be traced from one degree to another by the extent of its growth and consumption. It is gratifying, therefore, to find that our present annual production of this cereal amounts to about 200,000,000 bushels, and that our ability to increase it is capable of an almost unlimited expansion. It has always entered into our exports to an extent dependent chiefly upon the foreign demand, and experience has proved that the surplus of this grain, the amount we could spare from home consumption, is as elastic as India-rubber. If Europe needs our wheat, or our flour, and is ready to pay us good prices, either from a short crop, a

disturbed state of political affairs, or from any other cause, no one could set bounds to our surplus, because the more she wants the more we have to spare, and the less she requires, the more freely is it used at home. In other words, the amount of exports will be regulated chiefly by the price, and if foreign countries are willing, or are compelled to pay for it, we can supply them to any extent under any ordinary circumstances. The export, for instance, in 1850, amounted to little more than eight millions and a half, while in 1854 it went up to over twenty-seven millions of bushels.

We have seen that wheat was cultivated, to some extent, by the early settlers of the country. Occasionally, to meet the exigency of a short crop in England, France, Portugal, Spain, or the West Indies, it was exported, to some extent, in the early part of the last century. By the year 1750 New Jersey had come to take the lead of all the Colonies in raising wheat, and may be regarded as at that time the great center of the wheat-growing region. Its culture had grown to be very considerable along the Hudson and the Mohawk, and in Pennsylvania. Maryland, Virginia, and the provinces further south had made tobacco the leading object of culture, almost from the first of their settlement, and this crop constituted for a long time the most important export from the British provinces, though North Carolina had shipped, on an average, about 130,000 barrels of pitch, tar, and turpentine, and South Carolina considerable quantities of rice. But the product of tobacco had been diminishing for some years previous to the Revolution, on account of the exhaustion of the soil for that crop, and the planters there had turned their attention, to a greater extent, to the growing of wheat and other grain. They could by law export tobacco only to Great Britain, but they could ship wheat, flour, lumber, &c., to the West Indies and elsewhere. Wheat, therefore, had begun to enter into the exports of the more southern provinces prior to the Revolution.

But that the production of wheat and flour had not risen to anything like the relative importance which it holds at the present time, will appear from the fact that in 1791 the export of this grain was but 1,018,339 bushels, and 619,681 barrels of flour, while in 1800 it was but 26,853 bushels of wheat, and 653,052 barrels of flour. In 1810 the amount sent abroad was 325,024 bushels of wheat, and 798,431 barrels of flour. No statistics of the actual production of this grain were gathered previous to the census of 1840, but it is reported in that year to have been 84,823,272 bushels. From that time to 1850 the increase appears to have been but 15 per cent., the product, at the latter date, being 100,485,944. In that year, or rather in 1849, on which the return is based, Pennsylvania produced more than any other State in the Union, or 15,367,691 bushels. Its product at the last census was nearly 20,000,000, but the center of production has moved farther and farther to the west.

Since the practicability and economy of the reaper and other machinery became certain, the increase in the production of wheat has been more rapid, as appears from the fact that in 1860 the crop amounted to 173,104,924 bushels, and in 1870 to 287,745,626 bushels. Our exports of this cereal in 1860 amounted to about 12,000,000 bushels, in 1861 to over 20,000,000, and in 1862 to very near 30,000,000, a greater quantity than had ever been known before. In addition to the vast increase of this crop in the Middle and Western States, the production of wheat in California now comes in to swell the aggregate capacity of expansion, to an extent worthy of notice; for while in 1850 her product of wheat is returned as only 17,228 bushels, her yield of 1870 was nearly 17,000,000 bushels, with her resources but slightly developed. And when it is considered that

the great Northwest, Iowa, Minnesota, and the region lying beyond them, still remains, to a large extent, unoccupied, there seems no reason to apprehend that the growth of this important crop will not continue to increase in the future as rapidly as it has in the past.

The other smaller grains have never occupied so prominent a position in our agriculture, being grown more especially for home consumption, but in the aggregate they constitute no mean item of our national agricultural wealth. Thus our rye-crop, as returned in 1870, amounted to nearly 17,000,000 bushels, our barley to nearly 30,000,000, our buckwheat to nearly 10,000,000, and our oats to over 282,000,000. Rice, which in 1860 was reported at 187,167,032 pounds, had fallen off in 1870 to 73,635,021 pounds.

The potato is more universally cultivated than any other plant except, perhaps, Indian corn. It is scarcely more than a hundred years since it became universally recognized as an indispensible farm product. During the latter part of the last century, and the earlier part of the present, its cultivation in new soils was so easy, and its yield so abundant, that it became an important article of food. No account was taken of it in the census, however, till 1840, when the yield was reported as 108,298,060 bushels. Since that time the liability to disease has become so great that the production has not increased in the same ratio as many other crops, though the amount, by the census of 1870, including over 20,000,000 sweet potatoes, was 165,047,297 bushels. It has at times formed no inconsiderable item of export, though by no means to be compared in this respect with wheat and Indian corn. It is largely used in the feeding of stock in some sections of the country.

The culture of tobacco was undertaken by the settlers in Virginia from the very outset of the colony. It is recorded that in 1615 the gardens, fields, and streets of Jamestown were planted with tobacco. It immediately became not only the great staple crop, but the principal currency of the colony. By the year 1622 the product amounted to 60,000 pounds, and it more than doubled in the next twenty years. The culture of this plant was introduced into the Dutch colony of New York in 1646, though it never gained the prominence there that it did farther south. But Maryland, the Carolinas, Georgia, Louisiana, and later Kentucky, made it the leading object of their culture almost from their first settlement. It long constituted the most valuable export of British America; but the product per acre had been diminishing for many years before the Revolution, owing to the difficulty of supplying manure, and the consequent exhaustion of the soil. But from 1744 to 1776 the exports of this crop averaged 40,000,000 pounds a year.

Tobacco has now become a somewhat prominent crop in Massachusetts and Connecticut, and in both of these States its culture is rapidly extending. In 1850, for instance, but 138,246 pounds were raised in Massachusetts; in 1860 the crop increased to 3,233,198 pounds, and in 1870 to 7,312,885, while the crop of 1872 is probably at least 25 per cent. greater still. The aggregate yield of the country in 1840 was reported by the census of that year as 219,163,319 pounds, while in 1850 it was reduced to 199,752,655 pounds; but in 1860 it went up to 434,209,461 pounds, to fall again in 1870 to 262,735,021 pounds, a fluctuation to be explained in part by the many casualties to which it is liable, as damage by insects, hail, drought, frosts, &c.

The cotton-crop of the country has grown up entirely within the last hundred years. The first improvements in the process of spinning it in England were not made till the invention of Arkwright, in 1769, and the spinning-jenny of Hargreaves in 1770, and comparatively little cot-

ton had been raised in our Southern States previous to 1793, when Eli Whitney invented the cotton-gin. Up to that time the difficulty of freeing the cotton from the seed had been such that one hand could clean but a pound a day, and even at the high price of 25 or 30 cents a pound it could not be made profitable. By Whitney's invention a hand, instead of one pound, could clean 360 pounds a day. At about the same time steam was introduced as a motive-power in England, and that, with the great improvements in carding and spinning, enabled one man to do the work which it had previously required 2,200 men to do, in the same time, by the old methods. Machinery had introduced an entirely new condition of things. The effect of it was to produce a vital change in the state of affairs at the South, and cotton-growing very rapidly grew up to immense importance, constituting about a third part of the whole exports of the country. Each decade showed an increase of about 100 per cent. in production, till, in 1840, it had reached 744,000,000 pounds, six times the product of 1820. The quantity of cotton exported in 1792 was only 138,328 pounds. The quantity exported in 1860 was 1,765,115,735 pounds, or 4,412,789 bales of 400 pounds each, but the quantity produced in 1860 was 2,079,230,800 pounds, or 5,198,077 bales. This production had fallen off somewhat in 1870, when the quantity produced was reported as 3,011,996 bales, or 1,204,798,400 pounds.

The hay-crop of the country has also grown up almost entirely within the last hundred years, and considering the necessity that exists throughout all the northern portions of our territory for stall-feeding all stock from three to six months of the year, it has an importance there which it cannot have farther south. It has been asserted that the hay-crop, instead of forming a legitimate part of our national agricultural production, and going to swell the aggregate of its money-value, ought rather to be regarded as a tax imposed by the severity of the climate—a tax involving a vast amount of labor and time and money to which the farmer in our milder latitudes is not subjected. There may be some shadow of truth in this view of the case, and yet, like all other apparent hardships, it has its compensations, as the history of the various parts of our country abundantly demonstrates.

There is scarcely anything which a person who has become accustomed to the fine close carpet of green with which nature covers every hill-side and every landscape in our northern sections, would dispense with so reluctantly as the green turf of our natural grasses. But the greatest compensation to be found is the facility which the production of grass and hay gives for keeping up and increasing the fertility of our lands. The system of stall-feeding, for which the making of hay is designed to provide, is the only system by which a constantly improving mixed husbandry can be sustained; and the want of it may be assigned as the true cause of the exhaustion of the lands of Virginia under the constant culture of tobacco. The only substitute for it is the soiling system, and that becomes impracticable of general application in a country where pasturage and browsing are abundant and cheap.

The artificial production of hay is entirely of modern origin, as I have shown, but within the last quarter of a century it has increased with great rapidity, especially since the introduction of the numerous labor-saving machines has put it in our power to cut and cure our grasses so quickly and so cheaply. At the time of the first appearance of this product in our national census of 1840, the yield of the entire country was but 10,250,000 tons, and it had increased in 1850 to only 13,838,642 tons. But in 1860 we cut and cured over 19,000,000 tons, while in 1870 the

product was stated at 27,316,048 tons, an increase of more than 100 per cent. in twenty years. The money-value of this crop cannot, therefore, be less than $300,000,000, to which is to be added at least an equal amount for the value of grass for summer pasturage, making an aggregate of over $600,000,000 for the grass and hay crop of the country.

That the quality, and consequently the value, of the hay made now has vastly improved over that made a half-century ago, no one at all familiar with the subject can entertain a reasonable doubt. A great amount of thought and experiment has been directed to the best methods of production and of curing, while machinery has given us a greater control over the seasons, or rather has enabled us to avoid the exposure to the exigencies of the weather, to a vastly greater extent than was possible within the memory of men still living.

Let us see now what effect this progress has had upon the number and quality of our cattle. There can be no doubt that the idea of the possibility of improving the common stock of the United States was first suggested by the great results obtained by the early improvers of stock in England. The present advanced position of the stock interest of this country can be traced directly to the practical labors of Bakewell, the Messrs. Cully, Colling, Bates, and others, just as the first impetus which these distinguished breeders received can be traced to the efforts of such men as Lord Kames, "to improve agriculture by subjecting it to the test of rational principles," and Jethro Tull, (1740,) the inventor of the horse-hoe, the drill-husbandry, and many other bold and advanced notions. Tull launched out bravely into the field of experimental agriculture, and boldly threw open the door of improvement never again to be closed, and this new-born spirit of progress very soon appeared to spread; for it was only about ten years after him, or about 1750, when Bakewell began those skillful experiments in breeding and with such marked success as to impress his influence upon the progress of agriculture all over the civilized world. It was, of course, some years before Bakewell's magnificent results began to attract public notice, even in England, and their influence was much slower in reaching this country. It began to be felt here toward the close of the last century, or more properly, perhaps, directly after the close of the revolutionary war, for Mr. Goff and two other gentleman of Maryland imported some very large animals from England in 1783, which appear soon after to have gone into the hands of Matthew Patton, of Virginia, who, about the year 1794, removed to Kentucky and carried the cattle with him. A part of the same stock was taken to Ohio in the year 1800 by John Patton, a son of Matthew. These cattle were well known in Kentucky and Ohio, where they soon gained a wide reputation. There were a few other importations about that period, all of them in small lots, the most important of which were some cattle introduced into Maryland by a Mr. Miller, between 1790 and 1795, and a few short-horns into Westchester County, New York, in 1792 and 1796. These were probably the only importations made with any design of improving American cattle. Here and there a Jersey of that day, and possibly a very few individual animals of other breeds, brought over by ship-masters, are known to have been introduced and kept here, but they made no perceptible mark on our common cattle. Nor were there many or frequent importations until after the year 1820, though twelve head of short-horns arrived in Kentucky in 1817, and two more in 1818. It was in that year the celebrated bull Cœlebs, the founder of Colonel Jaques's "cream-pot breed," Fortunatus, owned by Gorham Parsons, of Brighton, and Young Denton, owned by S. Williams, of Northborough, were imported into Massachu-

setts, while Henry Clay introduced the Herefords into Kentucky in the year 1817, and Colonel Saunders's importation of short-horns arrived in that State the same year.

Of all these early importations made by public-spirited individuals, the Patton stock probably made the most mark. They did much to teach people the possibility of improvement. They were the pioneers, and, together with subsequent importations, not only infused their blood into the stock of that great western country, but did something to excite a spirit of emulation among the farmers there, and thus may be said to have laid the foundation for the splendid results which Kentucky, Ohio, and adjoining States have since realized.

After 1820, that is within the last half century, importations became more frequent. But though from time to time all the prominent breeds, the short-horns, the Herefords, the Devons, the Ayrshires, and the Jerseys, were introduced on trial, and, to some extent, crossed with our common cattle, the interest in stock was confined chiefly to individuals. The mass of farmers were slow to make changes, especially among the smaller farmers at the East. We may discover the first evidences of some general interest at the West about the year 1834, when the Ohio company for importing English cattle gave a great impetus to the spirit of improvement, and from that date the progress in cattle-husbandry became rapid, and we see the magnificent results of it at the present day. Early maturity and a tendency to fatten well are of transcendent importance to the western farmer who breeds to supply the stalls in our eastern markets, and he was quick to see how he could improve the intrinsic qualities of his stock in these respects.

In the eastern portions of the country the dairy early became the leading object of pursuit. Size and fattening properties were of less account, and hence we find that modern importations have consisted chiefly of the celebrated dairy breeds, of which the Ayrshires and the Jerseys have taken the lead, according to the special object proposed. These importations have been especially numerous within the last twenty years, till they have greatly modified the stock. In Massachusetts, for example, in 1853 there were less than seventy-five pure-bred Jerseys in the whole State. Now they number several thousands, and single herds now contain more pure and high-bred animals of this breed than could have been found in the State twenty years ago. And the same remark applies to the Ayrshires.

While the constant introduction of improved cattle from abroad has effected a very marked general improvement in the quality of our animals, the universal interest in cattle-husbandry has led to greater knowledge of stock, to better systems of feeding and management, and so to more satisfactory results. No longer ago than 1841, Mr. Colman, a well-known agriculturist, remarked that the general treatment of cows at that time, in New England, would not be an inapt subject of presentment by a grand jury. Now they are better sheltered, better fed, and more tenderly treated.

And while this progress in the improvement of the intrinsic qualities of our stock has been going on, the number of neat-cattle in the country has largely increased. The aggregate number by the census of 1840 was 14,971,586; in 1850 it was 18,378,907; while by the census of 1870 we find 23,820,608. Of these there were about nine million of cows. It will be seen that the amount invested in this class of live stock alone cannot be less than $300,000,000, the total value of the live-stock of the country being officially reported as $1,525,276,457.

It would be interesting to study the form in which the product, or,

in other words, the profit, of the vast amount of capital invested in neat-stock appears in different parts of the country. Space will admit of only a brief allusion to this point, but it is evident that throughout the Northern and Middle States it will appear very largely in the form of dairy products, while in the West we shall find it more generally in the form of slaughtered animals. Among the dairy-products we find by the last census that we sold 235,500,599 gallons of milk in its natural form. It went chiefly to supply our large towns and cities; the figures not representing the vast amount consumed at home, and thus contributing so much to the comforts and the necessities of life. At the same time we produced 514,092,683 pounds of butter and 53,492,153 pounds of cheese. These figures, large as they are, do not represent anything like the production of the country. The value of butter made in New York alone in the year 1865 exceeded $60,000,000. It is probable that the cheese made in factories, now numbering something like fifteen hundred, was returned under some other head, and that the 53,000,000 is the amount supposed to have been made in private dairies, for we know that the quantity of cheese made in New York State in 1864 for sale, in addition to that consumed on the farm, was nearly 72,200,000 pounds, while the product there, as in all the other Northern States, has been rapidly progressing since that date, owing to the constant expansion of the factory system and the stimulus of high prices. It is quite within bounds to say that the butter product of the country is fully 600,000,000 pounds, and that the cheese exceeds 200,000,000 pounds a year.

The dairy business of this country has developed with such rapidity and to such a degree of importance, with the aid of the highest intelligence and the application of the most consummate skill, as to be regarded as one of the highest triumphs of modern agriculture. Its annual product amounts to over $400,000,000, and the capital invested in it does not fall short of $700,000,000. It gives employment to a vast number of hands, and contributes to the comfort and the health and the wealth of all classes of the community.

Another product of the cattle-husbandry of the country, and a most important one whether considered from a financial point of view merely, or as furnishing a vast amount of food for the sustenance of mankind, is represented in the value of animals slaughtered or sold for slaughter, and by the census of 1870 we find this item amounts to about $400,000,000, or, more accurately, $398,956,376, a gain in ten years of very nearly $200,000,000. This, of course, includes the pork-packing business, till recently confined, to a large extent, to certain western cities, but now carried on as a growing business at many convenient points along our great lines of railway in other parts of the country.

Improvement in swine began less than three-quarters of a century ago. The first that excited any general interest was made by some animals sent from Woburn Abbey, by the Duke of Bedford, to General Washington. The Englishman intrusted with the care of delivering them seized an opportunity to sell them on their arrival in this country, but they were bred and became popular, and from all accounts they were splendid animals, small and fine in the bone, with a deep round barrel, short in the leg, feeding easily, and maturing early. They were long known as the Woburn breed, and in some sections as the Bedford hog, and were originated by a fortunate cross of the Chinese and the large English hog of that day. They would weigh from four to seven hundred pounds at a year old, with light offal and most excellent quality of flesh. They became very common in Maryland, Delaware, and Virginia, and they were sent to Colonel Timothy Pickering, of Massachusetts, and

became well known in that part of the country. They are now extinct. The Byfield breed, so popular for many years, originated in the same way. China thus did a good deal for our agriculture fifty years ago and more.

Previous to the introduction and diffusion of the Woburn, the Byfield, the Mackay, and more recently the Suffolk, the Berkshire, the Essex, and other popular English breeds, the classes of swine that prevailed in the Eastern and Middle, and especially the Southern and Western States, were coarse, large-boned, long-legged, and unprofitable creatures, better calculated for subsoilers than for the pork-barrel, though the grass-fed hog had done something to improve them as early as the time of the importation of merino sheep. But it soon became settled that neither the Eastern nor the Middle States could compete with the West in the production of pork upon a large scale on account of the difference in the cost of grain. The raising and packing of pork has, therefore, grown up very naturally in the Western States, and vast quantities are exported from there every year. At the same time the facilities for carrying on this business have been so greatly multiplied that the whole packing-trade has been reduced to a system so perfect that it may almost be said that no particle of the animal is now wasted, that all is economized, either for food or in the form of some commercial product, as bristles, lard, grease, stearine, soap, Prussian blue, &c., the aggregate of which collateral industries is scarcely less important than the preparation of food itself. The business involves a vast amount of capital, gives labor to a vast number of men, and adds amazingly to the material prosperity of the country.

Sheep-husbandry in this country has been subject to great vicissitudes. Sheep were imported by the early settlers, by the Virginia colony, as early as 1609, and they increased by 1648 to three thousand. The Dutch West India Company introduced them about the year 1625, but they proved to be too much of a temptation for dogs and wolves, for it is recorded that in 1643 there were but sixteen in that whole colony. They were kept upon the islands in Boston Harbor as early as 1633, and two years after there were ninety-two in the vicinity of Portsmouth, New Hampshire. It became the universal practice in the days of homespun for the farmer to keep a number sufficient to clothe his family.

The old "native" sheep was a coarse, long-legged, and unprofitable animal, and there was no improvement made in the breeding till towards the close of the last century, when, in 1793, the first merinoes, or fine-wooled sheep, were imported by William Foster, of Boston. They were wholly unappreciated, were given to a gentleman to keep, and he, knowing nothing of their value, "simply ate them," and a few years after was buying the same class of sheep at $1,000 per head. The embargo of 1808 induced many to turn their attention to fine-wool sheep, and soon after very large numbers of merino sheep were imported and distributed throughout the United States, and our modern sheep-husbandry, now grown up to its proportional importance, may be said to date from these importations.

The condition of the country gradually changed, and since the opening of lines of communication to the West, the Eastern States have found it hard to compete in the raising of fine wool with farmers who could furnish us with the raw material for our manufactories at a cost of a cent a pound or less for transportation. The growing of sheep for mutton and for wool has, therefore, been left to a great extent to the Western States and to Texas. We find, accordingly, that of the 28,477,951 reported by the last census, Ohio had about 5,000,000, Cali-

fornia 2,768,187, Michigan nearly 2,000,000, and Indiana, Illinois, Missouri, and Wisconsin over a million each. The quantity of wool raised exceeded a hundred millions of pounds, more than a fifth part of which was raised in Ohio. This was a gain of over forty-seven and a half million pounds over the product of 1850, and of very nearly 40,000,000 over that of 1860.

It will thus be seen that the production of wool constitutes no inconsiderable part of our agricultural industry, and that, in this respect, we have made a highly commendable degree of progress. This production, though little enough when compared with what it ought to be in a country so extensive and populous as ours, is still sufficient to place us in the front rank as compared with other wool-producing countries. And while the quantity has increased, the quality has been greatly improved since the modern interest in breeding began. At the World's Fair in London, in 1851, the fleece that commanded the highest prize for the fineness and beauty of staple, in a free competition with Spain, Saxony, Silesia, and other parts of Germany, was grown on the green pastures of Tennessee, while at the International Exhibition at Hamburg, in 1863, the Vermont merinoes carried off the prizes.

Whether the horse has actually undergone any improvement or not may admit of some question, but it is certain that the horses of this country have been greatly improved within the present century. The chief means of carrying on our early inland commerce, including a large amount of heavy teaming and transportation, was the horse. The public roads were bad, worse even than they are at the present day, and over these the freight of the country, whatever it was, had to be moved in wagons made to be capable of the hardest usage. The modern light carriage would have been comparatively useless in a new country and over such roads, while a speed now seen every day would have been quite unsafe. The mail contracts, even over a very large part of the country, when the post system was instituted, were based on a speed below four and five miles per hour. But there were no mails previous to 1790; and in 1791, the first year of the mail-service, there were but eighty-nine post-offices in the whole country, and less than two thousand miles of post-roads, and on these nine-tenths of the mail-service was done on horseback, the stage-service being very small.

It will thus be seen that the social conditions of the last century were not favorable to the improvement of the horse, certainly not to increase his speed, now considered indispensable. Fast trotting was scarcely known at the time of the old "Justin Morgan," foaled in 1793, nor was speed estimated as of special money value till the invention of the modern light buggy and the improvement of roads, but this quality has now come to be essential to the comfort and convenience of all classes of people. In this respect there can be no question that a great increase has been attained by careful breeding, especially within the last thirty years, while much greater attention has been paid to style, action, temper, form, constitution, and endurance, so that the aggregate money value of our horses has been enhanced by the higher general average of intrinsic good qualities.

These improvements are largely due, no doubt, to the frequent importation and infusion of thoroughbred blood into our stock. In some sections of the country, at the South and the Southwest, they may be said to be almost wholly due to this source. But in the New England States, and to no small extent in the Middle and Western States, they are due to the influence of two great classes of horses, both very celebrated roadsters, known as the Morgans and the Blackhawks, the former de-

riving their origin from the old "Justin Morgan," remarkable for compactness of form, strength, and docility, and unsurpassed for general utility; the latter excellent as roadsters, of a high and nervous style of action, a wonderfully elastic step, and a symmetrical and muscular form. These two families of horses have added many millions of dollars to the value of the stock of this country. They infused a new spirit into the whole business of horse-breeding, and gave us such a reputation for great success in this direction as to lead Professor Low, of Scotland, in his "History of Domestic Animals," to say of us: "They prefer the trot to the paces more admired in the old continent, and having directed attention to the conformation which consists with this character, the fastest trotting horses in the world are to be found in the United States."

But the draught-horse has not been neglected. The Conestoga, a large and heavy breed of horses, used mostly for the purposes of slow work in the drays of our large towns and cities, is extensively raised in some parts of the Middle States, while the Percheron has more recently been introduced and bred in some parts of the West.

The number of horses in this country, according to the last census, was 8,690,219, of which 7,142,849 were on farms, and the balance found in cities and large towns. This was a gain of more than a million in ten years, for, in 1860, the total number was reported as 7,434,688, of which 6,249,174 were upon farms. The number on farms in 1850 was 4,336,719, there having been no effort made to ascertain the number not kept on farms.

It will thus be seen that the capital invested in horses constitutes a large item in our national wealth; and to this should be added more than a million of mules and asses, the number returned in the census of 1870 being 1,125,415. The extent of our dependence upon this class of stock was never more completely realized than during the prevalence of the epizootic of last year, when the infinitely varied transactions of the country, social, manufacturing, and commercial, were so nearly brought to a stand-still for the want of the services of the horse.

This brief sketch of the rise and growth of the great agricultural interests of the country, involving such vast amounts of capital, giving employment and bread to myriads of men, and producing annually the incredible income of more than $2,447,538,658, would be incomplete without an allusion to the increase of intelligence, and the part which science has taken in bringing about such magnificent results.

I have already referred to the early attempts at associated effort and the growth of agricultural societies. Few and feeble enough at first, and slow in the growth of their influence among the people, they have now become a powerful aid in the progress of all departments of agricultural knowledge, and have grown up to a harmonious system of national, State, county, and township organizations, all active, not only in gathering and diffusing information, but furnishing a constant stimulus to new effort and to higher triumphs of practical skill.

To the earnest spirit of inquiry which these societies awakened in the community is due, in a great measure, the growth and respectability of the agricultural literature of the country. With the exception of four brief "Essays on Field-Husbandry," by the Rev. Jared Eliot, of Connecticut, the first of which is dated in 1747, I know of no agricultural book printed in the colonies previous to the Revolution; and all that followed that event for many years consisted chiefly of the more or less valuable papers submitted to the Massachusetts, the Philadelphia, and the New York societies, till the American Farmer was started in Baltimore in 1819. This is believed to have been the first regular strictly

agricultural journal published in the United States. Others soon followed, however, till we have now about a hundred periodicals devoted to the various branches of farm economy, some of which are of a very high order of merit. The aggregate regular circulation of these journals cannot be less than three hundred thousand copies, and they indicate a wide-spread desire for information which must necessarily have an important influence on the future development of this great interest.

The permanent agricultural literature of the country, now so extensive and so creditable, has grown up, for the most part, within the last twenty years. A few books of a high character appeared, from time to time, forty or fifty years ago, among them Coxe on Fruit-Trees; Thacher's American Orchardist; Arator, by Colonel Taylor, of Virginia; Fessenden's Complete Farmer, Buel's Farmer's Companion, &c.; but a large proportion of the farmer's reading, previous to 1850, consisted of English works, many of which were reprinted in this country. Since that date American treatises, in the highest degree instructive and useful, have appeared, and we have works upon landscape-gardening, fruits, animals, dairy-farming, drainage, and, in fact, upon subjects covering the whole range of farm economy, many of them of unexceptionable literary merit in point of style, finish, and perfection, and the results of accurate scientific research.

To bring the facilities for improvement within the easy reach of the largest number of people, the system of township and district libraries was first initiated by the State of New York, in 1837, with an appropriation of $200,000 a year for three years, and subsequent grants of $50,000. This example was followed by Massachusetts in 1839, and more recently Michigan gave each township the sum of $50 annually for this purpose. Indiana adopted the same policy in 1854, Ohio in 1857, the former appropriating $300,000 a year for two years, the latter $80,000 annually. Illinois and other Western States adopted a similar course, and it was properly regarded as admirably adapted to promote agricultural improvement, as well as the general welfare of the community. At the same time most of the States early adopted the plan of publishing and distributing large numbers of documents upon agriculture, gratuitously, among the people. These documents are, many of them, of high merit, containing the most recent scientific investigations, reports of experiments, and the observations of the most experienced practical men. Probably about two hundred thousand volumes are thus freely distributed through the farming community every year, with the addition of about as many more issued by the Department of Agriculture at Washington. These and various similar instrumentalities, all now in constant activity, are exerting a vast influence in developing our material resources.

The contributions of science to the progress of practical agriculture are by no means small or unimportant. Agricultural chemistry, itself in a state of transition and rapid growth, was never so helpful or so available to the farmer as at the present day. Though Sir Humphry Davy may be said to have opened the door to progress and improvement in this direction, in the early part of the present century, the accumulation of scientific facts was so slow that it was not till 1840 that Liebig announced propositions that opened a new world of thought and study, and awakened the attention of intelligent farmers to the importance of applying the results of chemical investigations, and, in some respects, essentially modified the practice of all civilized countries.

They were simple words to lead to such results. "To manure an acre of land with forty pounds of bone-dust," said he, "is sufficient to supply

three crops of wheat, clover, potatoes, turnips, &c., with phosphates; but the form in which they are restored to the soil does not appear to be a matter of indifference; for the more finely the bones are reduced to powder, and the more intimately they are mixed with the soil, the more easily they are assimilated. The most easy and practical mode of effecting their division is to pour over the bones, in the state of fine powder, half of their weight of sulphuric acid, diluted with three or four parts of water." Simple words, and yet they opened the way to the whole system of concentrated fertilizers which has extended so far in modern times and grown to such gigantic proportions as to affect the commerce of the whole civilized world.

Guano, to be sure, had first been brought to public notice by Baron Humboldt and by Sir H. Davy, but it was not till the researches set on foot by the revelations of Liebig that it was at all used in England. Twenty casks were landed there in 1840, and so great was the confidence in its use, as a means of renovating the soil and increasing the products of the country, that the importation increased to 2,000 tons in 1841, and to over 200,000 in 1845, the English trade alone employing, in that year, 679 vessels. In less than sixteen years from 1840 the quantity taken from the Chincha Islands alone reached the enormous figure of 2,000,000 tons, and the amount of sales in that time was over $100,000,000.

This precious fertilizer soon came to be extensively used in this country. In 1848, we imported over 1,000 tons; in 1849, over 21,000 tons; in the ten years previous to 1860 the quantity is reported at 842,787 tons. It is stated that in the ten years previous to 1870 the quantity imported was 387,585 tons, valued at about $6,000,000. But these figures give but a feeble idea of the extent to which special and concentrated fertilizers now enter into our agriculture, for many large superphosphate manufactories now exist in all parts of the country, while a great variety of other special fertilizers are made and offered for sale, some of them no doubt of great value, and others comparatively worthless.

In order to realize how immensely important these fertilizers have become in our modern agriculture, it is necessary to consider that the South is greatly dependent upon them, more dependent than the North, on account of the want of facilities for making and economizing farm-yard manures which the system of stall-feeding implies; but it is also fast getting to be recognized that they must come in as a necessary adjunct to farm-yard manures in high farming everywhere. And hence if the exact statistics could be known, and the extent to which they are used in all parts of the country, the figures would be truly astonishing.

The official inspector of fertilizers in Georgia, for example, estimates that the planters of that State alone pay over $10,000,000 a year for fertilizers, while it is stated, by those in a position to know, that in four months, from December, 1869, to April, 1870, more than 300,000 tons of fertilizers passed through the city of Charleston, South Carolina, that over 100,000 tons passed over the Georgia Central Railway and other points in that state; that over 6,000 tons, valued at $7,000,000, are manufactured at and sent from Chicago, on an average, every year. It is estimated that fully a half million dollars' worth are used in the State of New Hampshire every year. There are many single towns in Massachusetts that use from $25,000 to $35,000 worth, on an average, every year. There are several large fish-guano establishments in Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Virginia, one of which is known to make over 7,000 tons a year. These, it is true, are but isolated facts, but they serve to mark the changes which science has already introduced into our practice. A thousand other

facts might be mentioned to show what science has done to throw light upon the labors of the farm, and what progress has already been made in studying the composition of soils, of manures, of feeding substances, and of plants, while investigation and experiment are still being pushed with such vigor as to promise far more profitable and tangible results in the future.

To this end the National Government has come to the aid of the States in the establishment of agricultural colleges where special attention may be given to the various sciences which bear directly or indirectly upon practical agriculture. All the States have now accepted the grant made by Congress in July, 1862, and, in more than half of them, such colleges have been established and are actually in operation, in some form or other. They will undoubtedly do a good work for the rising generation; but whatever results may flow from them, they seem to indicate that the present is but the dawn of a new era—an era of improvements of which we cannot yet form an adequate conception. They show that a greater application of mind to the labors of the hand is to distinguish the future over all past generations, for the large numbers of young men who will go forth every year from these institutions, many of them thoroughly instructed in chemistry and kindred sciences, will give us, at least, the conditions for new discoveries which will open the way to higher triumphs, and so lead on to the golden age of American agriculture.

SILK CULTIVATION.

By Lewis Bollman, Esq.

The efforts made in the past to establish silk culture in the United States have not been successful. The well-remembered *Morus multicaulis* excitement was the result of dishonest speculation, and having no sustaining influences of a legitimate character it failed to establish a single instance of successful silk production. But the condition of our country in its relation to this pursuit is widely different now, and it clearly indicates that the time has come when silk culture can be profitably followed and, therefore, successfully established.

CAUSES THAT MAKE THIS CONDITION FAVORABLE.

The present condition of the foreign trade of the United States is not satisfactory. During the last five fiscal years the balance of trade against it was $510,886,873, and in the last fiscal year $182,547,568. This balance has caused during the same years an exportation of specie of $309,628,666, leaving $201,255,207 to be paid by the exportation of our national bonds. Two-thirds of the carrying trade employed by our foreign commerce is in foreign vessels, and the profits of this have been paid by us in these bonds. What the amount of it is, we have no data by which to determine, but it may be put down as not less than $50,000,000 annually. Add to these the large sums taken out of our country by Americans traveling abroad, and we can realize the causes that are so rapidly making our home national debt a foreign debt, and why we do not accumulate specie as a basis upon which our National Government and banks might safely return to specie payments.

It is difficult to see in what way these balances may be lessened. That the National Government will need large revenues to meet the interest on our public debt, and that duties, for many years to come, on foreign importations, will remain high, is very certain. That some of them, especially our luxuries, will be increased is more than probable. But to secure the industrial independence of our country, by producing commodities we now purchase from abroad, and for which our climates and soils are favorable, and by enlarging our manufacturing industries, so that much now imported may be produced at home, is the only way by which we may hope to have our foreign commerce permanently placed on a favorable basis, and some part, at least, of the products of our gold and silver mines retained at home.

Among the imports which have created this large balance of trade against us, is that of silk manufactures. In the last fiscal year it amounted to $36,448,618. Duties, freights, profits, and other charges will make the purchasing cost of this importation to our citizens not less than $66,000,000. This large importation, connected with the facts above stated, has acted most favorably upon the silk manufactures of the United States. According to the statement of a committee of silk manufacturers and operatives, to the Finance Committee of the United States Senate, the capital invested in them has increased from *three* to *twenty-five* millions of dollars, and the amount of raw silk imported in 1871 was 1,330,000 pounds. Such a development of the silk manufacturing industry secures a ready and permanent home-market to every pound of raw silk that may be grown in this country.

That the extent and progress of this manufacturing industry may be better seen, we take the following partial notice of it from the fourth annual report of Charles V. Riley, State Entomologist of Missouri:

> Half a dozen years ago, within a radius of fifty miles of New York, there were not fifty looms running on broad silks and serges, where now there are nearer five hundred. In and around Boston there are nearly as many; and Philadelphia boasts of about thirty. Last fall I visited Paterson, New Jersey, and spent some time in the surrounding country for the purpose of inquiring into this new industry.

At that place he found the largest establishments in the country manufacturing ribbons, dress-goods, trimmings, braids, &c.

In Connecticut $5,000,000 of capital are invested. But significant of the extent and excellence of their products is the large advertisement of the heaviest importer of the United States, Mr. A. T. Stewart, of New York. He advertises them as "American silks, manufactured by Cheney Brothers, Hartford and South Manchester, Connecticut, and sold wholesale by A. T. Stewart & Co., New York, Boston, and Philadelphia, and retailed at all first-class dry-good stores." Heretofore American silks have been sold as imported goods, but now their superiority is so clearly established that such concealment is not necessary.

The total value of American silks manufactured in 1871 was $30,000,000, and of the imported raw silk about $8,000,000. In 1872 the custom-house valuation of the raw silk imported was $5,625,620; other charges would make it equal to that of 1871.

Such a development of the silk manufacturing industry secures a ready and permanent home-market to every pound of raw silk grown here. Herein, then, is one of the favorable conditions to which we have referred, for heretofore our silk, like the wool of the Cashmere goat now, having no home-demand could not be sold, and hence not profitably grown. But there is another matter, in this connection, that requires a careful examination, namely,

THE PAST AND PRESENT PRICES OF RAW SILK.

Two fatal epizootic diseases have arrested silk production in foreign countries, especially in France and Italy. The government of England sought to revive the production of raw silk in its India possessions, and for this purpose required an examination of its past history in that country. We have a compilation of it by the under-secretary of India, Department of Agriculture, Revenue, and Commerce, and among other topics of interest he refers, incidentally, to the prices that formerly prevailed there. Raising the mulberry and gathering its leaves were often a separate pursuit in that country, and a prominent silk-grower, Dr. Roxberry, refers to the prices paid for leaves. They were worth 8 rupees (46 cents make a rupee) for *one-third* of an English acre, paying a rent of 2 rupees, and leaving a profit of 6 rupees, or $2.76.

The wages paid the feeders of the worms and the reelers of the silk were, respectively, $2.30 and $2.76 per month. For leaves in the Madras district, the price fixed by the government was 46 cents for 300 handfuls, each handful to contain 20 leaves. For cocoons, 5 cents were given for 300. One thousand cocoons were required to the pound, and of this pound two ounces were good silk, eight ounces dried worms, and six ounces refuse-silk and gum. According to this rate, it would require 8,000 cocoons to make a pound of reeled silk, and at the rates paid for cocoons $1.33 would be paid for these 8,000 cocoons.

Reeled silk in 1858 ranged from $1.84 per pound to $3.68. In 1851 the price for cocoons in France was 30 cents, a much better price than in India, but still unremunerative to our American labor. Against such prices it was vain to hope that silk culture could be established here.

Two causes have advanced the prices of raw silk: the general rise in prices of labor in all parts of Europe, and the fatal diseases among the silk-worms in Italy and France, to which we have already referred. In India, reeled silk had advanced to $3.68 and $5.75 per pound. The committee of American silk manufacturers and operatives, in their statement to the Finance Committee of the United States Senate, say that since 1861 the prices of all raw silks in the countries of its production have been more than doubled. The average price of the raw silks imported into this country in 1871 was about $6 per pound. But Mr. Riley, in the report from which we have quoted, speaking of the "Dale Manufacturing Company," at Paterson, New Jersey, says:

> Mr. Dale uses the best European machinery, and has a seri-meter and dynamometer, for testing the strength and elasticity of the thread, and scales for weighing it, all from Berthand & Cie, of Lyons, France. He employs three hundred and fifty hands, earning on an average from $5 to $6 a week. He uses nearly a bale (100 pounds) of raw silk each day, *for which he pays from $9 to $12 per pound.*

These prices, however, must be for the best reeled silks. When we notice, as we shall presently, the amount of food an acre of mulberries will produce, and the number of worms it will feed, it will be seen that these prices will give ample remuneration to the American laborer.

Having shown that the prosperous state of our silk manufactures must be continued by the protection they will find in the high duties that our national indebtedness will require, and that the present prices for raw silk give assurance that its production can now be successfully established, the next object of this article will be to show in what way this production can best be promoted.

THE EXPERIENCE OF OTHER NATIONS AGAINST LARGE INVESTMENTS.

The history of silk culture is as instructive as it is interesting. Large investments have been made by individual enterprise, and to these, governments have added liberal encouragement. The different kinds of silk-worms, and of the mulberry, have been brought together from every country. But however promising the beginnings have appeared, the ends have all resulted in failure, no matter whether the experiments were tried in moist or dry climates and soils; whether the mulberry was cultivated as standards or bushes; whether the worms were domestic or foreign varieties, or however complete the arrangements of the feeding-room. Our first duty, then, is to investigate the causes of these failures, and when we have done so the recommendations we will make can be better understood. Many leaders in new enterprises exhibit great zeal, but in their enthusiasm overlook the means of success. They are highly imaginative, seeing clearly enough the desired end, but not the obstacles that are interposed between the beginnings and this expected ending. The history of silk production abounds in such characters, and our own time is not free from them. The compilation of the under-secretary of India is instructive by indicating what these obstacles are, and we will now, as briefly as possible, point them out.

The production of raw silk includes two occupations, that may be separated or united, and these are the planting and cultivation of the mulberry, and the hatching and feeding of the silk-worms.

1. *The mulberry.*—The mulberry in India, whether of the native or Chinese varieties, generally grew well in a moist or a dry soil. Irrigation was necessary in some localities during the dry season, and this led to two modes of cultivating the plant, as standards or bushes. In the former a greater space was given to the plants, but they were crowded in rows in the latter, that no water might be lost in irrigation. Leading cultivators differed much as to the respective advantages or disadvantages of these modes. The standards were grown into small trees, but kept back so as to make the gathering of the leaves an easy task. In the bush form the plants were cut back often, and every third year cut down to the ground.

Under both modes the plants grew well until the leaves were plucked or pruned for the worms, then they so far degenerated as to yield an insufficient supply of food, especially in the dry season or in dry soils, and the leaves were so immaturely developed as to be an unhealthy food for the worms, producing fatal diseases and inferior silk. No care in the cultivation of the mulberry could obviate these consequences. One of the cultivators says that "without much care, constant attention, and labor," the plants cannot be kept in proper condition. The cultivation recommended was to dig up the earth after the gathering of the leaves had been commenced; the soil to be manured in October, and in February fresh earth to be put around the plants. When grasses grew, the ground was to be dug up as often as was necessary to destroy them. This cultivation was much like that of the grape-vine here. But while it could lessen it could not obviate sufficiently the evils we have mentioned to render the raising of the silk-worm a profitable pursuit on an extensive scale. The general practice among the large growers was to use the leaves *six* times during the feeding season, four by cutting branches, and two by stripping the leaves.

2. *The silk-worm.*—In the numerous trials made in India with the different varieties of the silk-worm, both by keeping them distinct and by crossing, the results have been unsatisfactory. The causes of this want

of success have been stated very differently by different writers, and with much contradiction. Some attribute it to degeneracy in the mulberry; others to the worms being stinted in their food by the native feeder, especially during the season of drought, when leaves were scarce; some to the weakened constitution of the worm, caused by a too rapid reproduction; others to want of ventilation and cleanliness in the feeding-room. The truth will, perhaps, be found more in all of these causes than in any one of them. The most successful of all growers was a native, Jaffir by name. He raised worms but *once a year*, stating that the leaves lose their best qualities if fed in the heat of summer; that young leaves were necessary for young worms. He fed no more worms than would produce about sixty pounds of silk. Under European feeders of long experience and much intelligence, with feeding-rooms so constructed as to avoid every objection, the failures have been more marked than among the native feeders, who raised but a limited number of worms as a household occupation, the feeding-room usually being in the upper part of their huts.

One of the most prominent silk culturists was a Captain Hutton. He regarded the dark stripes on the worms, when young, as indicating the original stock, and their light color, when grown, as a mark of constitutional weakness occasioned by too much forcing. For several years he selected for breeders those that longest retained these stripes, and said that this selection produced a more vigorous worm. But the final result may be seen in the following statement made by him:

I feel fully persuaded now, after several years of observation, that the constitution of the worm has been so thoroughly undermined that, although we may be able to restore it to its natural appearance, it will never be able thoroughly to shake off the various diseases to which it has so long been subject. The only way open to the sericulturist, therefore, is to reseek, in the original habitat, in China, for the wild worms in their natural state of freedom on the trees; and, should any of them be procurable, then may the stock in Europe be gradually renewed, and the present impending ruin be averted.

The epizootic diseases, which have been so fatal in France and Italy, had not then reached India, for these views of Captain Hutton were written in 1864. These diseases are attributed to the constitutional weakness of the worm, occasioned by an injudicious and forced "hot-house culture." The largest cocoons, regardless of their firmness and other qualities indicating vigorous constitutions of the chrysalis, have been selected as breeders, until the vital powers of the worm have been so weakened that they cannot resist the approaches of disease.

It will be seen that the silk-worm has become, in foreign countries, as constitutionally enfeebled as is the Irish potato. The rot is not more fatal than the *muscardine* and *pebrine*, the epizootics of France and Italy. But this enfeebled vital force is seen in the potato to yield to the least unfavorable condition of weather and soil, so that the quality of the potato is greatly impaired even when outwardly it is apparently healthy. So with the silk-worm. It may feed well, but the inferiority of its silk betrays this constitutional weakness. Captain Hutton's remedy is the same suggested to re-establish the vigor of the potato. But the seedlings from the Chilian importations rapidly yield to the influences that have made our older varieties so precarious. The causes, then, of failures in foreign countries are two. First, impairing the vigor of the mulberry plants and the nutritious qualities of their leaves, by too close and too frequent stripping and cutting during the feeding season; and second, weakening the vital forces of the silk-worms by injudicious forcing.

THE PRESENT CONDITION OF SILK PRODUCTION IN CALIFORNIA.

Nor is the present condition of silk culture in California satisfactory, but for very different causes, which, though discouraging now, do not threaten ultimate failure. A Frenchman by the name of Prevost, who had a practical knowledge of silk culture, settled in the valley of Santa Clara in 1854. Having little capital himself he induced a banker of San Francisco, Mr. Heutsch, to aid him. It was not until 1860 that they succeeded in importing good eggs, and in 1865 they had increased them to about 100,000. In 1868 others had entered into the business, the number of worms had been multiplied to 12,500,000, and the number of mulberry trees to 4,000,000. The fatal epizootic diseases in France and Italy had destroyed the greater part of the silk-worms of those countries, causing a large exportation of eggs from California at very profitable prices. It was this condition of the trade that caused this, what might well be called too rapid, progress in a new pursuit. As an instance of what the profit was, we take the statement of Mr. Garey, of Los Angeles, who, in one year, from *one acre*, realized over all expenses $2,700 *for eggs and cuttings.* One thousand dollars per acre was regarded as a certain profit. But in Japan, California found a successful competitor in supplying this foreign demand for eggs. The French and German war arrested the silk manufactures of France. The demand for eggs ceased. This temporary prosperity, and this temporary adversity, for such we regard the latter, created expectations not warranted, and a discouragement not well founded. As an instance of the first, we quote from the annual report of this Department for 1868:

> The breeding of the silk-worm in California has been commenced so extensively, and so profitably, and there is so much probability of its rapid extension, that it is already regarded as one of the most promising industries and important resources of the State.
>
> It is probable, from arrangements and preparations that are now being made, and from opinions expressed by silk-growers, that the number of cocoons will double annually for several years to come. This would give 6,000,000 in 1869; 12,000,000 in 1871, and 24,000,000 in 1872.

When the demand for eggs ceased, silk culture was regarded as a failure, and one of the California agricultural papers spoke of it as the poorest in its results of all the industries of the State. And yet the only permanent business by which the profits of silk culture should have been judged, the production and reeling of cocoons, had never been tried. The demand for eggs and mulberry-cuttings was accidental, and could not justify the rapid expansion to which egg production was hurried, and the extravagant expectations based upon it. The evils that have beset silk culture in foreign countries have not been felt in California, and an intelligent pursuit of it may always avoid them.

But the pendulum, as is natural, having swung from one extreme to the other, is now returning, to settle, as we hope and believe, in that medium which will more slowly, but surely, develop a great interest, for which much of the climate of California is so admirably adapted. The latest information from that State justifies this hope. The San Francisco Alta, of December 23, after a favorable notice of the condition of many of the largest mulberry plantations, says:

> The past failures in the breeding of silk-worms in California are chargeable mainly to inexperience. Many of those engaged in the business knew nothing of it practically; others, who had experience in Europe, ventured in beyond their means. Those who proceeded prudently have no reason to regret their investment, and they have no fear for the future.

There is, then, no difficulty in California that presents any real obstacle to successful silk cultivation. And as we have also seen that the past low foreign prices of labor and silk do not now exist to prevent, as they formerly did, its cultivation in other parts of our country, and that we now have a home demand, at fair prices, for all the silk we can produce, the only question is:

HOW BEST CAN SILK CULTURE BE ESTABLISHED HERE?

To this question a general answer may first be given: by avoiding the errors into which foreign silk-growers have fallen. These, as we have seen, consist in too often and too closely stripping the leaves and pruning the branches of the mulberry; in so breeding the worms that their constitutions have become enfeebled; in bringing together so many worms that their numbers alone cause fatal diseases. We must follow rather the success of Jaffir than the failure of more imposing and costly establishments, of what may be termed professional silk culturists. We must, in other words, *make it a part of the household occupations*, in which little capital will be invested, and the labor of women and children be given to it, who, otherwise, cannot now find so healthy and profitable employment. The superior climatic conditions of California may justify, to some extent, a different course. Whether they can, is the experiment now making there.

The recommendation to produce silk as a household employment rather than as a special occupation, and in small quantities rather than in large ones, is a departure from the course heretofore advised, and demands, perhaps, some further reasons for it than have already been given. The value of the annual product of raw silk is estimated at from $120,000,000 to $130,000,000, and the countries which chiefly produce it are China, Japan, India, France, and Italy. "Nine-tenths," says Mr. Riley, "of all the silk produced in Europe is raised in small quantities, that is, in separate house holds." The compilation of the under-secretary of India shows that this is the present state of seri-culture in all its provinces. And hence we find that the "Silk Supply Association" of Great Britain is endeavoring to extend its production in India, and for this purpose seeks—

1. "To stimulate the production of silk by *cottage cultivation* and otherwise, in every county where the mulberry-tree is capable of giving food to the silk-worm."

2. "To promote the exportation of cocoons from countries not well able to reel them, that is, from the households which prefer to produce cocoons only and not reeled silk."

From the reports on silk culture that have lately been issued by Mr. F. O. Adams, secretary to the British legation in Japan, we find that silk culture is carried on there in the most simple and careless manner, with the most primitive machinery, and that the people are actually ignorant of some of the simplest truths, the knowledge of which would enable them to more than double their products; that it is even worse in China, and that in Southern Europe most of the silk is reared by a peasantry which knows absolutely nothing beyond plucking the leaves and feeding them to the worms. Here, then, we see that after many and long-continued experiments in silk culture on a large scale, this industry has become a household pursuit in all silk-growing countries. The reasons of this we have already given, so that the recommendation we have made is but in conformity with their experience and practice.

Having indicated the mode by which silk culture may most profitably

be pursued, we proceed to lay down such directions as will aid the inexperienced safely to commence it. Let them not suppose from the failures we have so much dwelt upon, that silk culture is a difficult pursuit. On the contrary, it is a very simple one, as may be seen from what has just been said of it as it is in the houses of the foreign peasantry. The laws of healthy growth of the mulberry and of the silk-worm must not be violated, that is all—and this is not likely to be done in the household cultivation of silk. Every farmer knows that it is comparatively easy to raise a few hogs, or sheep, or poultry, but a large number breeds diseases not found among the smaller. Men in the household are healthy; collected together as an army, many diseases prevail among them, however excellent may be the sanitary regulations. This law of health is universal, and its action is stronger on the silk-worm than any other domesticated animal, because by improper breeding its constitutional vigor is so much impaired.

DIRECTIONS FOR THE INEXPERIENCED SILK-GROWER—ATMOSPHERIC CONDITIONS.

1. *Temperature.*—The warmth during feeding should range from 68° to 75°, and during the spinning of the cocoon about 80°. As all our climates show a much greater daily range of the thermometer, it is necessary to feed the worms in a room in which the heat can be regulated.

A climate, therefore, of sudden changes and of great extremes during the feeding and spinning seasons is not favorable for silk production. As the worms usually hatch in the latter part of April, where irregular weather prevails after that time, greater caution must be observed. In many parts cold changes are frequent until about the middle of May or the 1st of June, and then the heat quickly increases until it is above 80°—from 85° to 95°.

2. *Moisture.*—Wet weather is unfavorable, and hence a cold, damp atmosphere must find a corrective in moderate fires, which at the same time keep up a moderate circulation of the air in the rooms. How this is best done will be noticed when we speak of the proper construction of the feeding-room.

3. *Calmness and electricity.*—The central parts of the Mississippi Valley are the pathways of storms, which, though most violent in the winter season, yet in summer produce sudden changes of temperature and violent commotion in the atmosphere, and are often accompanied with heavy electrical discharges. Such storms often destroy a large portion of the worms, and where they frequently occur, silk cultivation should be cautiously tested. The climate of California is, of all others, most free from the extremes we have specified, but the southern portions of Kansas, Missouri, and many parts of the Southern States, are very favorable. Other locations have advantages sufficient, with proper care, to warrant success.

THE MULBERRY PLANTS.

1. *Kinds.*—The multicaulis and the white and black fruited are regarded as the best for feeding. In India the first is highly prized, as better adapted to a greater variety of soils, and as not inclined to grow into trees. It puts up many flexible shoots, with a rapid growth both of stalk and leaf, making the gathering of the latter easy to women and children.

2. *Propagation.*—The mulberry grows from cuttings, and is easily propagated by them. They may be set out in a nursery, and transplanted. If intended for tree-growth the distance apart depends on situation and closeness of pruning. Ten feet is one of the distances in India. But in the article of the San Francisco Alta, to which we have alluded, it is said of Mr. Brannan's plantation at Calistoga, which covers 100 acres, and is one of the best in the State, that "the trees are set twenty-four feet apart each way—an excellent distance." If the plants are to be grown in the bush form they are planted in rows; and these must be wide enough to allow good cultivation, and the leaves to be well sunned.

3. *Soil and exposure.*—The soil should be deep, rather dry, and not too rich. To make a healthy food and good silk, the leaves must not be too succulent, for in such the sap has not been properly elaborated, either from the soil being too wet, or the plants too much shaded. "Some plantations," says the Alta, "near the Sacramento are in a marshy soil, and the trees are too close together." These were not doing well. The exposure must depend a good deal on the peculiarities of each locality. If it is dry and warm, the exposure should not be so much to the south, but southeast, southwest, or east, or west.

4. *Cultivation.*—The ground should be kept mellow and free from grass or weeds. Where heavy spring-rains settle the soil too closely the plow should be used first, afterward a light cultivator. These are more efficient and speedy than the German hoe. All summer-plowing, by resolving the vegetable matter into gases, is "hard" on the soil. This and the large demand upon the plants for leaves require that the ground should be occasionally enriched.

5. *Gathering the leaves.*—When the plants are two years old the gathering of the leaves may be commenced. In India this was done much sooner, and as often as six times in the feeding season. But this practice was a leading cause of failures there, for the plants were dwarfed and the leaves were immature, causing diseased worms. Four different hatchings have been fed in California, but not upon leaves taken from the same plants. Two crops is the limit beyond which the feeder should not go. And this limit would be remunerating. An acre of plants will yield from five to six thousand pounds of leaves, and this amount would feed 50,000 worms, yielding from fifty to sixty-five pounds of silk, worth, in cocoons, say $3 a pound. This would give from $150 to $195 to the acre. Much larger estimates have been made, but we prefer stating the lower rather than the higher. If two hatchings are reared, this product would be doubled. The leaves should not be fed when wet, either from rains or dews, nor when wilted. Hence, for the morning feeding the leaves should be gathered the previous evening, and the night feeding from leaves gathered during the day. If gathered when wet there is danger of fermentation also, which is very dangerous to the health of the worms.

THE SILK-WORMS.

1. *Kinds.*—There are three kinds of silk-worms, annual, bivoltins, and trivoltins. The first produces but one brood in the year; the second, two; the third, three. The annuals are preferred, and of these there are three varieties in California—two Japanese, white and green, so named from the colors of their cocoons, and the Chinese white.

2. *Eggs.*—The eggs are kept in tin cases in a dry, cool place, not exceeding 40° temperature, and although they will bear a greater degree of cold, this is the best for keeping. They may be kept a twelve-

month in this way, and thus the hatching season be prolonged, or a selection made of the best months for feeding.

The number of eggs laid by one moth is stated to be about 300, and an ounce will hatch about 40,000 worms. From an ounce to an ounce and a half would be required for an acre of mulberries, but care should always be observed to prevent overstocking. It may well be called the universal vice of all farmers, and it was a prominent one among the silk-culturists of India.

3. *Hatching.*—The eggs should be kept at the temperature of 40° until the mulberries are putting forth their leaves. They may then be brought into the feeding-room, at a temperature of about 75°, which should be gradually increased about 8° until the eggs are hatched. The air of the room should be occasionally moistened by sprinkling the floor, in order that the worm may better free itself from the shell of the egg.

4. *Feeding.*—The duration of the life of the silk-worm varies a good deal, according to the warmth of the weather, health, and the variety, and ranges from thirty-seven to fifty days. The feeding season is about thirty-five days. During this period, and at intervals of about six to eight days, the worm molts, that is, sheds its skin. As this time is regarded as critical, care must be taken not to disturb the worm in any way, not even by feeding. Hence, the first step to be taken is to separate each day's hatching, so that those together may be molting at the same time. The best way to do this is to spread over the eggs a net made of mosquito-bar material, and tender young leaves of the mulberry placed upon it. The young worms will pass through it to feed on the leaves. At the end of each day the net may be removed, and another one, in like manner, spread over the eggs. When it may be necessary to handle some of the worms, the easiest way is to use a small camel-hair paint-brush.

The *number* of feedings during the twenty-four hours, as practiced, is different in different countries. But here there are two principal feedings, at about 5 o'clock a. m. and 10 o'clock p. m. Other feedings may be given between these if made necessary from any cause. At every feeding a net should be spread over the worms and the fresh leaves put upon it, as this mode enables the room to be kept clean easily. The excrement of the worms passes through it, and when they have ascended through the net to the fresh leaves, the remains below it may be swept away without disturbing the worms.

The *amount* of leaves to be given each day is as follows: before the first molting about 15 pounds for every 50,000 worms; between the first and second moltings about 30 pounds; between the second and third, 60 pounds; between the third and fourth, 140 pounds; between the fourth and fifth, 300 pounds; and during the fifth the same amount, making altogether 5,070 pounds, about the yield of an acre of mulberries.

As the worms increase in size they should be *separated.* At first they are fed in shallow trays or on shelves, which they will not leave. But as they increase in size they become too much crowded. The net is employed to effect this separation, by removing it when about half the worms have passed through it to the fresh leaves. Another net, with fresh leaves, is then to be placed on the remaining portion. Nets with large meshes must be used when the worms have so much increased in size as to go through them with difficulty.

When the feeding is with the pruned branches the nets may be dis-

pensed with, the branches being so arranged as to leave open spaces through which the worms may ascend and the excrement fall down.

5. *Molting.*—As the time of molting approaches the worms feed less and acquire a more shining appearance. As already remarked it is a critical condition, and especial regard should then be paid to cleanliness. The worms of most vigorous health will first molt. They may be kept without feed for twenty-four or thirty-six hours in order to wait for those that are later. But there will be some less healthy and so late in molting that it is best to put them in a separate tray or shelf, for this difference will become greater in the succeeding moltings. If this delay, too, is occasioned by disease, it may be communicated to the healthy portion.

6. *Spinning.*—When the worm ceases to feed after its fourth molting, preparations should be at hand to form proper places for spinning the cocoon. Twigs of the mulberry, willow, or other trees, or of stiff weeds, as the mustard and rag-weed, may be laid crosswise so as to leave open spaces of an inch in width in which the worms may spin. Or straw, fifteen inches in length, may be tied at the ends and these pressed toward each other so as to leave a similar space in the middle; or, if the feeding has been done on shelves, the straws may be cut so long that by pressing the ends on the lower and upper shelves a like opening will be made. The places where the worms are should have the light excluded, for the worm prefers to spin in the dark. The later worms should not be kept under those that are spinning, for their excrement at this time is soft. The temperature of the room should be about 80° while the cocoon is making.

7. *The cocoons.*—A low sound is heard during the spinning, and when this has ceased the cocoons may be taken out and assorted. The silk around should be preserved, for, although inferior, it is used by the manufacturer. The cocoons that offer most resistance to pressure should be put together, as it indicates better silk and more perfect health. From these should be selected such as are intended for breeding purposes. The silk of cocoons that are very soft is generally inferior in quality.

8. *Killing the chrysalis.*—The worm as it is in the cocoon is called the chrysalis, and in a few days it will emerge from it in a butterfly form. To aid its exit from the cocoon it secretes a fluid which destroys the silk at one end, and this destroys also the value of all of it, as the silk cannot be reeled. To preserve the value of the cocoons the chrysalis must be killed, and to do this they are placed in shallow pans, and these are put in ovens heated to the boiling-point of water, 212°. Or they may be put in boiling water for a short time, or steamed for half an hour.

9. *Drying the cocoon.*—After the chrysalis is destroyed the cocoons should be placed on shelves in a well-ventilated room, and gradually dried. They should be stirred frequently until the drying is well advanced. Ordinarily it is not completed before two months. They may then be kept for a long time, or sold, or reeled. There is a great tendency in this country to separate the manufacture of an article from the production of the raw material, and reeling will soon become established in every neighborhood where cocoons are grown. Manufacturers of silk will buy cocoons, and we would not advise the households to reel silk until they have made progress in raising the worms, and find that they can devote a part of the home labor to reeling. It does not come within the province of this article to speak of the machines used for this purpose; that may be done in a future article.

THE PRODUCTION OF EGGS.

The constitutional weakness of the silk-worm, to which reference has so often been made in this article, demands every effort that will strengthen it. The epidemical diseases which have been so fatal in France and Italy are attributed to a constant selection of the largest cocoons, size only being regarded, until all, though large, were weak. To produce healthy worms does not so much require care and skill in breeding as a forbearance from a course that forces nature in a particular direction, at the expense of the vital powers.

The importation of foreign eggs should be avoided, unless from countries where the worm is healthy. Those in California may most safely be relied on. The first duty we owe to this important industry is to start with healthy worms. The success of Jaffir in India was deemed so important that the official authorities declared, "It is of great importance that Jaffir, and others who follow his example, should meet with every encouragement from the local authorities." "I particularly questioned him," says Lieutenant Dowlett, "regarding his stock of eggs; he assured me that, so far from deteriorating, acclimatized eggs were far better than any others, and that for twenty years and upward he had raised his own eggs." "As I was under the impression," he continues, "that the silk-worm was very delicate, I was much surprised to find Jaffir's, though under such poor shelter and so crowded, looking so fine and well." A few sheds, low and ill-ventilated, contained his stock. "Jaffir told him that he would be glad to give his worms change of air and position oftener than he could afford to do with the space at his command, but he laughed at any elaborate sanitary arrangements, and said it would never do for any but amateurs to adopt them."

The silk-worm has suffered more from the empirical treatment of pretenders than from all other causes.

The female worm is larger than the male, and in order to have a proper number of each sex, an equal number of each, as far as can be judged, should be selected and weighed together. The average weight is thus ascertained, and those above it may be relied on as females, those below it as males. After the cocoons are thus selected they should be fastened to the shelves or trays by some adhesive substance, as paste, so that the moth may readily leave the cocoon. The additional necessary directions we give in the following extract from Mr. Riley's report, and in so doing acknowledge our obligations to him for his admirable and practical remarks on the silk-worm. It is not often that we meet a practical entomologist:

> The moths come out most abundantly during the early morning hours, and as they issue they should be taken by the wings and the sexes kept apart for a short time. The males may then be placed with the females. Coitus, according to the best breeders, should not last more than six or eight hours, and at the end of that time the couples should be separated by holding the female gently by the wings with one hand and pressing the abdomen with the other. The males may then be thrown away and the females placed for a few minutes on sheets of blotting-paper, where they will free themselves of much yellowish or fulvous fluid, which would otherwise soil the cloth upon which the eggs are to be laid. They may then be placed side by side in trays lined with linen cloth, when they will immediately commence depositing. The trays may be tipped up at one end so that they incline a little, as the moths are then more apt to lay their eggs uniformly. They should also be kept in the dark, in accordance with the nocturnal habits of the moth. Most of the eggs will be deposited in about twenty-four hours, and the moths may then be thrown away, as eggs deposited after that time are not as well impregnated. No deformed moths should be used. The eggs are best preserved on the cloth where originally deposited, as they are protected by a natural coating of varnish, and, being fastened, the worms, when hatching, eat their way out better.

BUILDINGS.

Whilst Jaffir was successful in his ill-ventilated and crowded sheds, others failed with expensive houses, having every appliance which convenience, ventilation, and warmth demanded. The principal cause of this success and failure we have pointed out in the facts that he did not bring together more worms than produce sixty pounds of silk at one feeding, nor did he enervate the worms by injudicious breeding, as did those who were unsuccessful. Care ought to be observed in localities as to the exposure of the cocoonery, where the temperature is subject to extremes, and especially that of heat, for this is more frequent during the feeding season than its opposite, and especially so where large establishments are contemplated. Speaking of a prominent failure, the San Francisco Alta says: "The Davisville plantation, which was the largest in the State, was rooted out when the trees were four years old. The cocooneries there were not properly protected against excessive heat."

The exposure should be such as will protect the building from the cold winds of the northwest, and from great heat also, by being open to the southwest winds. In household silk-cultivation this can ordinarily be sufficiently accomplished by a hedge and shade trees. Against wet weather, or local dampness, a large open fire-place is necessary, that proper dryness may be secured, and such moderate ventilation as will keep the air pure, without creating a draught.

FOREST CULTIVATION ON THE PLAINS.

THE CLIMATE AND CULTIVABLE CAPACITY OF THE PLAINS CONSIDERED IN REGARD TO THE AMELIORATIONS POSSIBLE THROUGH GREATER PROTECTION BY FORESTS.

By Lorin Blodget.

The existence of forests in a state of nature over almost the entire area occupied by civilized nations is strong, if not decisive, proof that they hold relations to the soil and surface that cannot safely be disregarded. In such parts of the Old World as have been wastefully occupied in this respect, and where the native forests have been wholly removed and the surface denuded, there has been a great waste of the ancient fertility of the soil, and often an exhaustion, if not an absolute destruction of the nations that once flourished in those countries. Arabia, Palestine, and various parts of Asia Minor, with parts of Greece, and Turkey in Europe, are illustrations of this waste and ruin in the East, while Spain is perhaps the most striking example in the West. It is indisputable that the powerful nations that for centuries occupied those countries first rose to strength on the natural wealth of soil and forests which originally occupied the surface; and their decline and exhaustion were at least coincident with the waste and denudation of the country. The lands became less and less productive, and arid plains only remained where general cultivation and dense populations long existed, until finally the exhausted surface would maintain no greater population than we find occupying it now. A long process of vigorous and constant effort to restore what has been destroyed can alone make those countries what they were, even within the best known periods of history, and this course their enervated people are not likely at any early day to attempt.

The greater part of the surface of the United States was originally covered with a forest growth remarkable for its uniformity, for the magnificent size of the trees themselves, and for its decisive influence on the local climate, as well as on the condition of the surface soil. Lands which, after clearing and cropping for thirty years or more, appear hard, refractory, and liable to destructive droughts, were originally entirely free from either of these conditions, and, within the personal knowledge of many of their present occupants, were amply supplied with moisture, as well as loose and fertile in character of surface for cultivation. No observant person can fail to be impressed with the importance of arresting the progress of these changes, and most persons have no hesitation in tracing these results to the removal of forests. Careless cultivation has much to do with it, undoubtedly, but worse than that is the loss of the protection forests give, and the steady supply of moisture to the soil which their presence secures.

It is, in fact, only recently that settlements have extended beyond the limits of the vast primeval forest extending from the Atlantic nearly to the Mississippi River. Within a comparatively few years we have come to occupy a surface quite novel to the first experience of our people, in the prairies and the plains. They have been a problem to us from the beginning, one not easy of solution from the point of our previous knowledge. As a contrast with the forests which were the natural covering of the surface, the difference was so great as to imply essential differences of both soil and climate, since it could only be explained by supposing that neither soil nor climate permitted trees to grow.

But a very brief period of actual occupancy has put a very different construction on the case as a whole, and the partial incredulity at first existing as to the possibility of growing forest-trees has almost wholly disappeared. It has been found that neither of these conditions presents any obstacles that cannot be promptly overcome on the prairies proper, or the plains nearer the Mississippi which are called by this name. These prairies are, apparently, no more than natural fields or clearings, preserved from growing up to timber chiefly by the annual fires and the existing turf which covers them. If once the surface is broken, and the fires are restrained, they are immediately covered with natural growths of some form of forest-trees, possibly not the best or most valuable, but such as at least serve to vindicate their capacity to grow any ordinary forest-trees.

The absolute origin of the prairies is obscure; it may be simply the constant invasion of the forest by fires starting on the distant and dry interior, and carried eastward by the prevalent westerly winds. Certainly the great tertiary formations of the country west of the Missouri were brought to their present condition as plains, and were undoubtedly exposed to the same general conditions of exposure they now present. On these the forests could scarcely get a footing so strong as to maintain themselves with severely trying winds sweeping over them from the west. They therefore continued to be the plains they were in the beginning, and the districts bordering them at the east were always invaded by the destructive agencies originating at those western limits. The agency of savages is well known to be as destructive in the matter of kindling fires as the presence of civilization, and for ages, therefore, the greater body of fertile and well-watered lands, now described as prairies, have been swept of their covering of vegetation annually, as far as fires could effect its destruction.

The plains and prairies are in an unnatural condition of denudation

and exposure if these views are correct. The first question is to inquire whether any agencies in our power to control can be employed to restore what is wanting, and to protect what we still have from further destruction. An act for the restoration and preservation of forest-trees is the first and most effective step that is suggested. The power of the General Government can to a great extent control the conditions under which the lands may be taken up, and this power, directed wisely, will not be to the prejudice or injury of any class of occupants of the soil. The existing difficulties of climate and surface are their greatest obstacle, and if general improvements are practicable through prompt legislation and united efforts, the first to receive the benefits will be the settlers themselves. In these views, a bill prepared by the honorable Commissioner of Agriculture, in 1873, (H. R. No. 3008, second session Forty-second Congress,) provided effectual guarantees, first, for the preservation of existing timber; second, for the planting of a certain proportion of all lands sold or granted on which such proportion does not naturally exist; and third, the general planting of tracts of unsold lands, in the least protected districts, by the direct agency of the General Government. And to afford settlers and occupants special inducements to such planting, lands to the extent of a quarter section would be given to a settler who should plant and cultivate so much in forest for five years.

That all these powers and requirements are within the authority of the General Government to exercise and enforce, cannot be doubted if the exigency is so general and important as to demand them as a condition of successful occupancy of the soil itself. The lands of the plains generally certainly cannot be sold to realize any revenue to the Government without some such provision. If granted or conveyed without sale, it is doubtful whether they can be occupied, and thus the primary duty of providing for their safe occupancy fails to be discharged by the Government.

Undoubtedly the first among the questions to be considered is the possibility of the improvement and the ameliorations proposed to be effected. If tree-planting is itself impossible, or if no practical amelioration of soil or climate results from it, the exercise of compulsory powers would at least be of doubtful propriety. For these reasons it is proposed here to treat the question apart from any doubtful or disputed propositions on this general subject, and to consider fairly whether portions which admit of no doubt, and are not open to question anywhere, do not fully sustain the general principles of the measure proposed in the Commissioner's bill.

The mutual relations of surface to climate cannot be disputed, and they must be considered fairly in any discussion of the modes of restoring better local conditions, or of averting further deterioration. The greatest of all agencies for the retention of water on the surface, wherever falling, for promoting its absorption and penetration of the soil, and for rediffusing its vapor in the atmosphere, is what we designate as the native forest. Forests are, in nature, the growth of centuries under conditions generally favorable; and they resist, for periods equally long, the action of even unfavorable conditions. When destroyed, they are not readily restored through natural agencies, and the denuded surface changes materially in the direction of aridity, and in the waste of nutritive elements in the soil. And the destructive power of extreme seasons of drought, of fire, and of special acts of man, in a savage as well as in a civilized state, is such that no conclusion adverse to the possibility of forest-growth can be drawn from the absence of such growth on any part of the plains yet explored.

This last point is so important to the subject of this inquiry that it should be further elucidated. It was an early and common error at the first occupancy of the prairies of Indiana and Illinois to infer that some inherent difficulty in the soil or climate prevented the growth of forests on them. Yet experience very soon proved that no more prolific soil, or more favorable conditions of climate, existed in the world to favor forest-growth. Special adverse influences, which we cannot yet fully understand, alone prevented the growth of forests on these prairies originally. Local peculiarities had, indeed, crept in which could be controlled only by the intervention of energetic efforts of men associated either as individuals or through legislative action. The stiff prairie-soil was itself the growth of centuries, and the annual fires had become as inevitable, almost, as any feature of the climate. While these continued no forests could spring up on the prairies and retain their hold unaided, however perfect the adaptation of soil to forest-growth.

Passing westward from the prairie districts, as they are generally known, we enter by insensible gradations on the surface of the plains. The long-standing belief that great absolute change of soil, or change from soil to desert sands and rocks ensued, has been dissipated, as before stated. Anywhere on the road to Denver and the foot of the mountains the most recent and ample testimony is that water alone is needed to make the surface productive under cultivation. And perhaps the most remarkable of the favorable facts developed is that which shows that sage-brush and alkaline soils mean little or nothing more than that the requisite spring and summer rains are deficient. With a restoration of these rains, or with irrigation enough to compensate for them, the surface, previously covered with saline efflorescence, and having a forbidding aspect under a sparse and stubborn growth of sage or grease-weed, at once yields ample and constant crops of wheat and every other grain. It is a gratifying relief to find these, and valleys and plains, a few only of which are to be seen east of the summit ranges of the Rocky Mountain plateau, but which are abundant and general in the basin districts of Utah and Idaho, are all within easy control of energetic settlers, and all can be turned into almost gardens of fertility, when irrigating-streams are within reach.

But the specially adverse feature of the plains is the absence of forests and timber. All the surface east of the mountains is and has been especially exposed to the destructive local and general influences which have kept forest-trees from the prairies of Illinois and the adjacent States. And with this wholesale denudation has come an undoubted exaggeration of all the extremes of climate natural to the latitude. The winds of the spring and summer sweep over vast stretches of surface which afford little or no evaporation to mitigate their dryness, and they therefore become excessively dry. The rains which fall, even profusely, at certain seasons, chiefly in the spring, are thrown rapidly off from the dry turf of the surface; and a sudden flood of the upper rivers of the plains may be followed in twelve hours by winds entirely dry, and which, in sweeping over the surface, get little or no accession of moisture from the rain which fell profusely but a day before. The natural moisture of the climate is therefore wasted, and in consequence of this waste is insufficient to sustain the first efforts at cultivation.

Under these general views it is clear that the practical problem of improving the plains and even the basin districts of the interior of the continent opens very favorably. In one mode or another it is certain that the greater part of the surface can be brought under cultivation, and its value can be vastly enhanced over the previous general belief

as to such value. Geological research has greatly enlightened us as to the origin of the strata which make up the general surface, and the plateaux and mesas are nowhere more forbidding or barren than the plains or valleys. In the immediate mountains, also, great numbers of instances appear in which, as in the Uintah Mountains, the high lateral ridges are composed of nearly horizontal strata, with a level surface, and the ridge or declivity is wholly one of denudation through an originally level mass. Grazing-tracts and forest-belts of singular luxuriance lie along these summits and ranges, and these have a great value directly available in the immediate occupation of the country.

The actual climate of the plains and basin districts has now been very closely determined by scientific observation. The most valuable agency has been that of the military posts, at all of which careful records are kept of the quantity of rain falling, as well as of the temperature, and often of the humidity, winds, and other conditions. At the eastern border, and at a few localities farther west, individuals have kept equally valuable records, from the whole of which a close approximation to a positive climatology may be deduced. From these it appears that the rain-fall of every season continues abundant as far westward as the ninety-eighth meridian, nearly. In Kansas, on the Arkansas and Kansas Rivers, the dry surface begins soon after passing Council Grove and Abilene, and from Fort Zarah to Fort Reynolds, on the Arkansas, a distance of three hundred miles, the country is very dry. On the Kansas River, from Salina to the sources of the Smoky Hill Fork, and beyond these to Denver, the deficiency of rain is considerable, but not so great as on the Arkansas. On the Platte, from Fort Kearney to the foot of the mountains, the like deficiency exists, but still less than on the Kansas, the degree of deficiency being less on going northward. Again, on the line of the Canadian River, at the thirty-sixth parallel, there is less deficiency of rain than on the Arkansas at the thirty-eighth, to whatever cause this may be due. In the "Bad Lands" of Nebraska and Dakota, and in the valleys east and south of the Black Hills, there is a material deficiency of rain, but on the upper plains of the Missouri, the Yellowstone, and other rivers northward, the deficiency in spring and summer is not so great. The deficiency here spoken of is more definitely the sensible deficiency experienced in cultivation or shown in the vegetation and surface evidences than the measured deficiency in quantity falling. It is a striking fact that the actual quantity falling, as shown by the rain-gauge, would in most climates be considered ample. At Fort Kearney, on the Platte, for instance, at the very border of the arid region, as generally described, the quantity of water falling in spring and summer is one-half greater than that falling in the same seasons on the border of Lake Ontario, New York.

Locality.	Years.	Spring.	Summer.
		Inches.	*Inches.*
Fort Kearney, 99° west longitude	11	9.52	11.35
Oswego, New York	8	6.18	7.63
Niagara, New York	10	6.87	9.81
Fort Laramie, 104° 47′ west longitude	10	6.25	5.09
Fort Riley, 96° 25′ west longitude	6	6.48	9.37
Fort Randall, 98° 12′ west longitude	3	4.93	7.16
Denver, 104° west longitude	2	5.51	1.00

Here we see that no western post is greatly deficient in spring rains as compared with Central New York, and only Denver and Laramie are materially deficient in summer rains.

These facts are very striking, and on examination they are found to characterize the entire area of the plains at the most critical season for vegetable growths, the three months of spring; and, in fact, the month of June is also included. It has long been known that many of the rivers of the plains have floods in May and June; this is especially true of the Kansas, which has its rise in a secondary tract of high lands, a hundred miles east of Denver, and of the general line of the foot of the mountains. Recent observation shows that this tract is quite well watered in spring and early summer, at least in contrast with the line of the Arkansas, and with the overshadowed valleys, at the very foot of the mountains. It is sufficient proof of this profusion, that the entire volume of the Republican Fork, Solomon's Fork, and Smoky Hill Fork, of the Kansas River, as well as of several tributaries of the Platte on the north, and the Arkansas on the south, is derived from this isolated area. The water thrown off from this tract, four degrees of longitude in length, or from 100° to 104° west longitude, and two degrees of latitude in width, 38½° to 40½° north, is fully as great as the average water-drainage of an equal area in Michigan or New York.

The characteristics belonging to it undoubtedly are simply those of profuse rain-fall and too rapid drainage to the river-beds. There being no forests, and little or no such abundance of other vegetation on the surface as would serve to arrest and diffuse the rain, either by absorption into the soil or by retention in swamps, grass or wood lands on the surface, the chief value derivable elsewhere from such profusion here disappears. In this tract, surrounded as it is by plains of such extent as to prevent any protection from prairie-fires, there has really been no chance in a state of nature to attain forest growths. The narrow line of cottonwoods and willows at the river borders was only preserved by being almost in the water, and however adequate the natural rain-fall to sustain forests, there was still no chance for them without the protection of man. On this extension of prairie soils and uniform surface, where every acre is really arable land in the fullest sense, would appear to be the most favorable spot for initiating practical measures to intersperse forests with cultivated fields. Two or three great railroad lines traverse it, affording ample means for communication and the support of settlements. Establishments on the northern and western borders of such a tract are essential, and here they are easily made; indeed, they are to some considerable extent made already, the line of the Union Pacific Railroad, and its branch to Denver, being already a line of not distant settlements, and of possible complete connection of protecting establishments.

The precise quantity of rain falling on this district should be ascertained. To do this, observations must be taken at the sources of the Smoky Hill and Republican Forks of the Kansas River, about 103° west longitude, and also on the South Platte and its tributaries. It is probable that the whole territory intervening between the Platte and the Arkansas is better watered than the immediate valleys of either of these rivers. In attempting to determine the quantity for the plains generally, we have a great abundance of observations in Kansas, Nebraska, and Minnesota, the most conspicuous feature in all cases being the profusion of rain from May to July. Generally, in Kansas the summer aggregate is greater than in any locality or State of its latitude eastward to the sea-board. This average ranges from fifteen inches at

the eastern to eleven inches at the western border of the settled portion, at 97° west longitude. At Fort Kearney, on the Platte, two degrees farther west, the quantity for summer is also eleven inches, with a quantity in May even more abundant. Indeed, at all these stations, while the first three months of the year are very dry, April begins to be profuse, and May to July are always profuse in rain-fall. The abundance of rain is simply attendant on the advance of the season, and in Northern Texas, where March and April are the growing months, the rains are then most profuse. In the Indian Territory March begins the season; in Southern Kansas April; and in Nebraska May. The following table, giving the best results of observation of rain-fall, may be given here as a more convenient place for reference than elsewhere:

Depth of water falling in rain and snow (in inches and hundredths) at various stations on or near the plains.

Stations.	Latitude.	Longitude.	Altitude.	Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Spring.	Summer.	Autumn.	Winter.	Year.
	° ′	° ′	*Feet.*																		
Fort Towson	34 0	95 33	300	14	3.19	2.99	4.38	5.33	5.84	5.78	4.62	3.96	3.41	4.59	4.23	2.84	15.55	14.36	12.23	8.94	51.08
Fort Arbuckle	34 27	97 09	1,000	9¼	0.89	2.98	1.12	2.39	4.46	3.16	3.13	4.12	3.38	2.08	2.97	1.57	7.97	10.83	8.43	5.44	32.69
Fort Belknap	33 08	98 48	1,600	5 5-6	0.47	2.29	1.32	0.88	4.21	3.98	2.49	2.97	2.77	2.92	2.65	1.10	6.41	9.44	8.34	3.86	28.05
Fort Scott, Kansas	37 45	94 35	1,000	10¼	1.92	1.18	1.79	3.70	7.08	8.13	4.55	3.69	2.30	2.66	3.46	1.69	12.57	16.37	8.42	4.79	42.15
Council Grove	38 40	96 30	1,200	6	1.17	2.31	1.81	3.16	5.14	5.33	5.19	6.39	4.59	3.11	1.75	1.14	10.11	16.91	9.45	4.62	41.09
Manhattan	39 15	96 40	1,100	9	0.52	1.63	1.36	3.10	2.37	4.86	4.90	3.52	3.35	1.69	1.52	1.06	6.83	13.08	6.56	3.21	29.69
Fort Riley	39 03	96 35	1,300	14	0.77	1.01	0.75	1.74	3.01	3.93	3.00	3.22	3.09	1.21	1.15	0.74	8.50	10.15	5.45	2.52	23.62
Fort Atkinson	37 47	100 14	2,330	1	0.04	0.49	0.96	3.38	9.34	4.35	3.00	2.80	3.85	6.81	1.39	1.60	13.68	10.15	12.05	2.13	38.01
Bellevue, Nebraska	41 20	95 57	1,250	8	0.89	1.57	0.79	1.92	3.76	3.58	3.91	3.82	3.18	1.76	1.36	2.10	6.47	11.31	6.30	4.56	28.64
Omaha Mission	42 05	96 10	1,500	6½	1.03	0.84	1.42	2.56	4.42	3.00	4.42	3.57	3.06	1.68	1.67	1.13	8.40	10.99	6.41	3.00	28.80
Fort Kearney	40 38	98 57	2,360	14¼	0.59	0.43	1.25	2.26	4.30	3.69	4.74	2.70	2.29	1.57	0.97	0.46	7.81	11.13	4.83	1.48	25.25
Fort Randall	43 01	98 12	1,456	8 5-6	0.49	0.42	0.99	1.10	2.67	2.30	1.78	2.56	2.43	1.09	0.47	0.30	4.76	6.64	3.90	1.21	16.51
Fort Laramie	42 12	104 31	4,519	12½	0.61	0.46	0.84	1.06	3.74	1.90	1.63	1.37	1.17	0.97	0.84	0.57	5.64	4.90	2.98	1.64	15.16
Denver	39 40	105 10	5,500	2	0.81	0.97	1.26	2.80	1.45	0.29	0.51	0.20	2.85	0.54	1.82	0.75	5.51	1.00	5.21	2.53	14.25
Fort Lyon	38 08	102 50	4,000	1	0.32	0.12	0.16	2.09	4.84	1.40	2.53	0.37	0.04	0.00	0.07	0.15	7.09	4.30	0.11	0.59	12.09
Golden City	39 45	105 20	5,240	1	......	1.00	1.40	2.80	5.40	2.10	2.37	0.45	2.20	......	......	......	9.60	4.92	......	......	......
Fort Massachusetts	37 32	105 23	8,365	5	0.34	0.86	0.61	1.15	1.19	0.71	2.01	2.84	1.80	0.87	3.61	1.07	2.95	5.56	6.28	2.27	17.06
Great Salt Lake City	40 46	112 06	4,320	5⅔	1.68	2.25	2.47	1.39	1.34	1.49	2.54	1.01	1.37	2.20	2.35	3.76	5.20	5.04	5.92	7.69	23.85
Camp Douglas	40 39	111 42	4,800	3¼	2.77	1.53	2.87	1.11	1.58	0.60	0.84	0.60	0.99	1.79	1.71	4.18	5.76	2.04	4.49	8.48	20.57
Fort Defiance	35 43	109 10	6,500	8½	0.98	0.70	0.84	0.67	0.52	0.74	2.44	2.73	1.86	0.70	1.16	0.87	2.03	5.91	3.72	2.55	14.21
Fort Ruby	40 01	115 35	5,922	1¾	2.24	0.23	1.63	1.57	2.04	0.59	0.59	1.82	0.53	3.33	0.94	1.76	5.24	3.00	4.80	4.23	17.27
Deer Lodge City	46 15	112 30	6,000	2¼	1.45	1.81	1.64	1.40	2.28	1.97	0.58	0.58	0.86	0.48	1.38	0.49	5.32	3.13	2.72	3.75	14.92
Helena	46 45	111 50	4,150	1⅛	2.12	0.43	1.15	1.80	4.30	3.50	0.07	0.20	1.80	2.61	0.50	1.00	7.25	3.77	4.91	3.55	19.48
Fort Benton	47 52	110 40	2,674	1½	1.01	0.37	1.11	1.81	2.86	1.14	4.62	0.61	1.82	......	......	1.30	5.78	6.37	5.00	2.68	19.83
Fort Sully	44 39	100 40	1,491	½	......	......	......	......	2.98	2.34	6.48	1.53	0.21	......	......	......	......	10.35	......	......	20.00
Cheyenne	41 12	104 42	6,000	1	0.02	0.27	6.38	1.61	1.99	1.84	3.90	2.05	1.03	......	......	......	3.98	7.79	......	......	16.00
Corinne	41 30	112 18	5,000	1	0.70	2.42	0.55	1.43	2.66	0.47	0.11	1.04	0.14	0.35	3.22	4.04	4.64	1.62	3.71	7.16	17.13

The above table affords unexpectedly favorable results, particularly in regard to the critical seasons of spring and summer. Of more than twenty stations near or on the plains, but two or three show marked deficiency of rain, even in summer; and in spring, April and May at the South, and May and June at the North, are always marked by a fair amount of rain.

There is, it is true, need of observation at a much greater number of places, and conducted for longer periods. A few years more of the present fullness of observation will warrant more decisive judgments as to the quantities anywhere at hand to be utilized in some way more than is done at present. If, at the localities of Fort Atkinson, Fort Kearney, and Fort Sully, on this side of the plains, a summer aggregate of 10 inches or more is to be relied upon, and at Fort Lyon, Golden City, Laramie, and Cheyenne, 5 to 7 inches can be relied upon for the same season, the assurance is certain that forest-growth may be anywhere maintained after the first efforts and dangers of planting are past. Comparing these quantities with the records of rain-fall in Europe, the facts appear in a still more striking light; the whole interior, and indeed much of the west of Europe, having a small quantity of rain. The following are condensed results by seasons, and generally derived from long periods of observation:

Locality.	Spring.	Summer.	Autumn.	Winter.	Year.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
London, England	4.09	6.00	6.15	4.45	20.69
Marseilles, France	4.67	2.17	8.00	5.23	20.16
Berlin	5.66	7.21	5.45	5.24	23.56
St. Petersburg	2.89	6.73	5.11	2.93	17.65
Simferopol, Crimea	3.22	6.01	3.40	2.20	14.83
Lougan, South Russia	3.57	4.99	3.02	2.28	13.87

The whole central area of Europe exhibits like small quantities of rain, and the simple measurements of quantity on the plains of the United States by no means sustain the idea that such aridity exists as to require irrigation. Yet the small number of rainy or cloudy days, and the sudden outflow of the water in streams, as well as its rapid evaporation in the somewhat caustic atmosphere that sweeps over the plains, reduce the practical value of the rain falling to little more than half the quantity when deposited elsewhere. At Niagara and Rochester, New York, the quantity of rain in spring is less than 7 inches, and that of summer $8\frac{1}{2}$ to 9 inches only. At Council Grove, Fort Riley, and Fort Atkinson, positions reaching westward from the settled border of Kansas, the quantity is fully equal to or exceeds that at Rochester. Even at Golden City, Fort Lyon, and Denver, it is nearly equal in spring, though deficient in summer.

Several instances of especially favorable results in the rain-fall of single months for the year 1872 are afforded at the stations of the War Department Signal-Service on and near the plains; among which are the following, showing very ample rains at the critical months, April to July, (quantities in inches:)

Stations.	April.	May.	June.	July.
Denver	2.09	3.74	2.07	2.69
Corinne	1.43	2.66	0.47	0.11
Cheyenne	1.61	1.99	1.84	3.90
Virginia City	0.35	1.78	0.74	2.73
Fort Sully	(No obs'n.)	2.98	2.34	6.48
Fort Benton	0.67	0.64	1.14	4.62
Omaha	3.84	6.35	3.91	6.36

The records at all points of observation are unfortunately too brief to afford any proper means of determining whether the quantity of rain is greater now than it was ten years since; though great force attaches to the almost universal belief in such increase on the part of the more intelligent residents and observers in the interior. The range of non-periodic variation is very great in all parts of the temperate latitudes, and it is possible that our earliest practical experience on the plains was in a period characterized by a succession of dry seasons. In Utah it is quite clear that practically the warmer seasons have become far more profuse in rain-fall than they were fifteen years ago; and at the eastern foot of the mountains, the settled localities, as Denver, and the districts both south and north of the original center of settlements, afford marked evidence of improvement. But there are no statistics of measurement which afford any positive evidence; the periods observed at the military posts being quite irregular, and not sufficiently extended to establish any law of increase.

On no point of practical results are both writers and observers more thoroughly agreed, than in affirming the value of forests, as agents of at least local amelioration of climate. An essential condition of the growth or improvement of a soil by chemical decomposition of its elements and by the deposit in or on it of vegetable mold, is the constant permeation of its strata by the water of rains and snows. These waters bear more or less ammonia always with them, which is the chief agent of rock decomposition, and in practical experience the forest-soils of the Central States are found deeply decomposed and fertilized. They are also free in absorbing water, holding it long, and yielding it slowly by subsequent evaporation and by drainage through the surface strata in permanent springs. The first result of too great and general clearings of the forest is to dry up the springs, and next to harden the surface-soil, forming a stiff mass which sheds the water of ordinary rains, and can only be permeated by water and by the roots of plants when thoroughly broken up and fertilized by artificial means. After long periods of exposure the surface becomes so hard and refractory as to bear little or no resemblance to the soft, moist, deep soil of the original woodland. The denudation of the hills and upland plains of any one of the Central States will show a marked decline in productive capacity, from that belonging to the original or first occupancy. At that time the wealth of the soil had not been wasted, nor had the general exposure of the surface deprived the crops of the shelter of adjacent woods, preventing the dry and caustic winds from exhausting the vitality of every plant exposed to them.

The ordinary condition of the atmosphere, as it sweeps in general progress eastward, is that of an absorbent of moisture. When rain is not actually falling the air is taking up moisture, and if nothing is offered to it by ordinary evaporation from the surface the condition soon be-

comes arid, or deficient in the quantity necessary for favorable action on vegetable growths. Though a desert surface intensifies the aridity, yet an ordinarily dry and denuded surface yielding no moisture by evaporation soon renders the surface atmosphere unduly dry and caustic. The summer winds may even approach a sirocco in quality, and those of winter are piercing and destructive. The water-surface of any one of the great lakes is quite sufficient to neutralize either extreme for the countries lying on the line of atmospheric circulation across these lakes; and while the actual rain-fall of Buffalo, Niagara, and Lockport is but small, the air is rarely or never biting in its aridity, as when it reaches the eastern and cultivated border of the plains after traversing hundreds of miles of surface destitute of water, forests, or other moisture-yielding conditions.

The practical question is whether, with a general climate of constant rain-fall, the smaller quantity of such rain-fall can be diffused and distributed so as to sustain the constant vegetation of the central and eastern States. What may be accomplished by replacing that which we are accustomed to regard as the natural covering of the soil in the forests? And what further by cultivation, by special irrigation, and by shelter from the present unrestricted sweep of surface winds? In answer, it may at least be assumed that important ameliorations of the local and surface conditions are certainly within control. And the whole field of action is in a climate especially mild as compared with the north of Europe. The denuded uplands of Germany, the exposed mountain districts of Scotland, and other localities of the eastern continent where cultivation struggles to reclaim every inch of surface that may be made to yield the smallest product for human support, present examples of deterioration. The entire area of the plains, and all the plateaus, mesas, and basins of the interior need nothing but water to make them productive in valuable staples. Everywhere within the United States it is warm enough, and the natural soil is rich enough. So great is this natural capacity that every observer and writer who has visited these districts believes that irrigation would be profitable in every case where it would be possible; the general presumption being that many of the valleys and river bottoms near the mountains will continue to be deficient in rain, and can only be cultivated by the aid of irrigation. The concentration of settlements in the basin districts of Utah and Idaho has fortunately tested this capacity for profitable cultivation by irrigation very thoroughly, and it is pronounced successful in all cases. The mountain-streams are abundant and permanent, showing a profusion of summer as well as winter rains on their summits. The rain which would be sufficient, probably, if equally distributed over valleys as well as mountains, is condensed by attraction on the higher ranges, and therefore is not constant in the valleys. In short, it is not the general average supply that is so much at fault as the local distribution.

But the districts on the eastern slope of the greater mountain-plateaus are probably the most difficult to deal with. The great ranges have exhausted most of the moisture of the aërial volumes from which the summer rains fall, and until their disturbing influence has been wholly exhausted the deficiency of rain continues. Probably a belt at Denver and near the eastern foot of the mountains has the quite insufficient quantity of 15 inches of rain annually, and another, stretching two hundred to three hundred miles eastward, has but 20 to 24 inches. This is not of itself decidedly adverse, and cultivation might here succeed without irrigation, if adequate shelter and local ameliorations could be introduced. Possibly a portion of the drier belt could be so cultivated

ultimately; but, for the present, irrigation would be necessary to break up, permeate, and prepare the soil.

The proportion of the rain-fall absorbed by the soil, or otherwise retained temporarily on the surface, must vary so greatly with different soils and exposures as to render calculation difficult. It is said that a share of the surface of the plains near the sources of the several forks of the Kansas River is somewhat loose in texture, readily taking in a large proportion of the rain-fall, which subsequently rises in and near the bed of the several streams. In most of these river beds water is readily found a few feet from the surface, even when none is visible without digging. Generally, however, the surface is hard and repellant, throwing off nine-tenths, at least, of all the water falling in rain and snow. The proportion retained or absorbed should be not less than one-fourth; and certainly in the original woodlands of the Central States, much more than this proportion was the permanent stock of the loose, leaf-mulched surface, the ponds and the saturated strata of soil through which the water slowly made its way to the living springs.

As an illustration of the value of the several natural agencies for diffusion of moisture, the condition of the country bordering on Lake Ontario may be contrasted with that of Eastern Virginia and Maryland. The actual injury occurring from periods of extreme dry weather is less in New York and Canada, near this lake, and with less than 30 inches of annual rain-fall, than in Virginia and Maryland with 44 inches. The large forest and water surface lying west of Lake Ontario softens the surface atmosphere, and increases the rain-fall to some extent, while accomplishing far more of benefits through general diffusion and utilization of the quantity of water that does fall. It is possible that the great lakes themselves have been the chief agents in creating and preserving the forests of all the States near their latitude, and that in their absence the open plains and denuded surface would have stretched far toward the Atlantic coast.

In regard to the distinctive question of forest-planting, perhaps the most important statement that may be made is that it can never be unprofitable, whether general consequences of value are derived from it or not. For proprietors or occupants of the soil in any degree, from the owner of a single quarter-section to the most extensive proprietorship, the most remunerative return for labor or investment would be to clothe a share of the surface with a growth of timber. Railroad companies may in this way protect their lines of track from drifting snows, and at the same time secure large advances in the value of their lands along any great thoroughfare. At either the eastern or western border of the plains proper facilities already exist to prepare and plant at little absolute cost, and the subsequent protection from fires and other casualties can be secured through systematic breaking up of the original surface. Experience has everywhere shown that the growth of both deciduous trees and evergreens is very rapid on the soil of the prairies and plains. Five or six years from the planting would give a surplus in thinning sufficient to pay the cost of removal, and eight or ten years would give fencing material and fire-wood in abundance. The locust, Osage-orange, and ailanthus are perhaps the strongest and most rapid growers; they are very hardy, and would test the question of growth and protection to the surface very promptly. On the northern and cooler districts evergreens might be more efficient, especially in forming protection-belts against the winds. While on the prairies almost anything will grow, practical experience is wanting as to the question what varieties of timber are most available; there is nothing in the known

conditions of climate or soil in the general surface adverse to the reasonable expectation of success. Localities will probably be found on which no efforts would be successful, but of the general capacity of the climate of the plains to sustain forests there can be no doubt. And this is also as decidedly true of deciduous trees of the ordinary class belonging to the older forests of the East, as it is of evergreens, cottonwoods, and poplars. On the northward slope of the drainage toward Hudson's Bay, in Dakota and Minnesota, the river borders in localities protected against fire often show fine clumps of elms, maples, and oaks, not less luxuriant than those of Michigan or Ohio. On the more distant plains of the Athabasca and its sources even more abundant natural forests of maples, oaks, and other deciduous trees are found, the single condition necessary to their existence appearing to be protection against fire and casual destruction.

At Fort Kearney, on the Platte, with a rain-fall of 25 inches, there cannot be greater intrinsic difficulty in planting forests than on the Moose or Pembina Rivers, at the forty-ninth parallel, and on the same meridian. A narrow belt east of the Black Hills and west of the Missouri, embracing the "Bad Lands" and the Missouri Valley for some distance above Fort Sully, appears to be more decidedly deficient in rain at the critical seasons than any part of the country surrounding it on either side, possibly due to the exhaustion of the surplus moisture in the season of showers by the elevated mountain-summit of the Black Hills, the Big Horn, and Wind River Mountains. Two years of observation at Fort Pierre, 1855 to 1857, would appear to support this view, as also do the general and local descriptions of the country by travelers and residents. Observations at Fort Sully, however, which is very near Fort Pierre, both being on the Missouri near the forty-fourth parallel and the one hundredth meridian, show for 1872 an abundant summer rainfall; while in 1856 there were but 3½ inches, in 1872 the quantity was 10 inches. The range between the quantities in extreme years is at this point undoubtedly great, and the adverse influence on general cultivation may be considerable.

But none of this difficulty exists after passing a short distance westward at the same latitude. The bottoms of the Little Missouri River abound in timber and grass, and all the country west of the one hundred and third meridian appears to have a favorable climate, the Powder River and Yellowstone districts particularly. In the more decided valleys of Montana, near the Rocky Mountains, local deficiencies exist, and irrigation is necessary. Facilities exist for such irrigation, however, in abundant mountain-streams and easy diversion of their waters, but far the greater body of open country north of latitude 44° appears to need no irrigation. At Fort Randall, on the Missouri, at 43° north latitude, and not far below Forts Sully and Pierre, before referred to, there is a reasonable abundance of rain from May to September; and on all the coteaux, or higher prairies of Eastern Dakota and Western Minnesota, there is no material deficiency. The same conditions are known to apply to the Red and Pembina River districts, and to the country on the Assiniboine and the Saskatchawan, chiefly beyond our boundary. As far as surveyed, the Upper Yellowstone district is found to be profusely watered, though the vicinity of the new park is too greatly elevated to be free from summer frosts.

Descending toward the Missouri the climate is greatly softened, however, and it is especially mild about Fort Benton, where, also, though but 2,600 feet above the sea, the spring and summer rains are reasonably abundant.

On all the plains proper—and the greater prairies of the western parts of Kansas and Minnesota should be classed as plains—the special deficiency of timber is such that every inducement exists to cultivate forests as a source of profit. The sweep of the fires by which the native forest has been kept down needs only to be averted to favor the most liberal growth of either deciduous or evergreen trees. The value of the protection tree-plantations give can at once be realized, and while co-operation and legislative aid are desirable in the highest degree, there is still a certain reward within reach of every single and isolated planter. Protection against the sweep of surface-winds, especially in winter and spring, is a great need of the prairies, even in Illinois; and a practical comparison of their productiveness when partially sheltered, as is so common through the natural oak-openings of Wisconsin, shows a great preference over the entirely naked rolling prairie. Lands so sheltered can be more profitably cropped than the unsheltered rolling prairies, especially in wheat. The requisite detail as to modes of planting, and to classes and varieties of timber-trees, has been clearly explained in several publications by practical cultivators. The commissioners appointed under an act to promote the growth of forest-trees of the State of Wisconsin have, in their reports, thoroughly treated the practical questions of actual planting. Many other official reports and private publications have urged the same general policy, and have explained the conditions of its operation for different localities. All these writers ascribe important modifications of the local climate to the influence of belts or bodies of woodland, and in no case have results been reported adverse to the hope of such benefits.

Under these circumstances the time is particularly favorable for legislative action, inciting or positively requiring tree-planting as a condition of the original disposal of the public lands. Public opinion is so favorable on the point of anticipation of personal profits to every planter that no burden would be imposed by such legislation which would not be returned to every land-holder directly; the general benefit resulting would be additional to the personal benefit. No more favorable circumstances for initiating measures on the part of the General Government could be expected in any case.

In common cultivation extraordinarily favorable effects are produced by the simple process of mulching; covering the surface with some light, loose mass, composed of vegetable matter undergoing slow decomposition, if possible, but nearly the same benefits are realized by covering the surface with material affording protection simply. Soils that would otherwise harden to absolute imperviousness, and destroy the local vegetation in consequence, are by mulching kept uniformly moist through long periods of absence of rain. The same principles apply to a forest-covered surface; loose deposits of leaves usually practically mulch the actual surface, retaining moisture for a long time after its absolute loss on open plains; and, in addition, the entire depth of the forest is in a moistened and moderated condition, holding more or less of the products of constant evaporation, and tempering the winds which sweep over it by absorption of heat and diffusion of humidity. The agency of forests in such surface modification cannot fail to be great in the moderate climate of the latitudes of the plains. At higher temperatures, and with an intrinsically barren surface, the resulting influence might not be perceptible, but cool as the summers are at any point from the thirty-eighth to the forty-ninth parallel, the surface-winds need only slight accessions of humidity to rob them of special aridity.

PROPORTION OF RAIN-FALL THROWN OFF IN SURFACE-DRAINAGE.

The actual proportion of the rain falling on any district, thrown off in the ordinary surface-drainage, has been calculated with care in many cases as a basis for the construction of works for the supply of water to cities. The results are variously stated at from 50 to 75 per cent. of the annual fall, in average districts of the Atlantic States. Ellet calculated the discharge of a stream called Anthony's Creek, a tributary of the Greenbrier River of Virginia, by daily measurements for one year, to be 70 per cent. of the quantity falling in that year, and 65 per cent. of the average fall for a period of years. In all these localities of the Eastern States a fair proportion of woodland, and also of loose soil and cultivated surface, would be included, thus affording conditions much more favorable to the retention of moisture, and its absorption into the soil, than those existing on the general surface of the plains. If the rain-fall of Maryland, at 44 inches, should average to throw off 60 per cent. as a basis of available drainage for water-supply to reservoirs, there would be 26½ inches of waste, or of ordinary flow into rivers, and 17½ inches permanently diverted by absorption and evaporation. And of the quantity thus retained and re-supplied to the air some portion would inevitably be re-deposited in rain; and thus the primary rain-fall, as it may be called, may at the season of showers receive considerable augmentation. And this increase once established, it becomes permanent so long as the surface continues favorable, increasing the humidity of the local atmosphere and the cultivable capacity of the soil.

Applying this analogy to the plains, a quantity of 20 inches now found falling on the dry surface, and of which 70 to 90 per cent. is immediately thrown off in the streams and rivers, may, by covering the surface with forests in part, and by breaking up the hardened turf in cultivation, diminish the waste from 80 to 60, or even 50, per cent., retaining, say, 6 or 8 inches of this quantity in some form, and at least preventing the immediate waste from which no secondary benefits can now be derived. The practical value of the primary water-deposit cannot fail under such change of surface to be equivalent to an addition of 10 per cent. to such original quantity; sufficient in many cases to secure important results, and to obviate deficiencies that are now decisively adverse to whole classes of crops. A further measure may be suggested here, in the construction of what may be called temporary reservoirs, in which the surplus of the profuse showers falling in spring and early summer may be retained to be distributed by channels of irrigation, or to secure general benefits by simple retention. The cost of such works need not be great, nor need they be more than such temporary obstruction of the smaller drainage-channels as is within the power of a few settlers at any locality to construct at any time. For these, as for all preliminary works of the kind, the agency and means of the railroad companies may be easily and effectively employed. Whatever may be found practicable in this respect, it is clear that 8 to 10 inches of rain-fall in the three or four months of most rapid growth can be utilized to a much greater extent than to permit 80 per cent. of the quantity to run off at the moment it falls, affording no useful result, and only flooding the valleys of the Kansas and its tributaries at a time when no surplus is wanted in these valleys. Travelers and surveying parties have frequently found these rivers flooded in May and June from the rain-fall of the plains alone, and not from the melting of mountain snows. The Platte has generally a rise in June, due to its mountain supplies, but

the Kansas does not receive any drainage from the mountains proper; the upper tributaries of the Arkansas and the Platte cutting off the entire mountain drainage, and covering all the district at the immediate eastern base.

There is every encouragement, indeed, to efforts directed toward the utilization and retention of the actual rain-fall of the central portion of the plains, that portion near and between the existing Pacific Railroad lines. And the modes suggested are chiefly such as are intrinsically calculated to repay any expenditure, personal or general, whether expected general consequences shall be realized or not. Timber-cultivation is in itself profitable, and its success certain, so far as any requirements of soil and climate are concerned. It may, therefore, be undertaken by the isolated settler, by the colony where association is most readily accomplished, by the railroad for the protection of its own line and the improvement of its own lands, and by the States and the General Government, as a condition of the original conveyence of title. In either and all these cases the sufficient remuneration for any expenditure can scarcely fail, and the general result will exhibit benefits proportioned to the extent of the co-operation by which any work may be undertaken.

To an agriculturist, the theory and the practical results of mulching are so constantly recalled in this connection that we cannot forbear a further reference to this point. On soils unbroken and hard in surface even the abundance of eastern summer rains is almost wholly thrown off, and they suffer from drought in a climate with an average annual fall of 4 inches per month. But the same surface, if covered with loose materials, if in forest, or if under deep and thorough culture, scarcely suffers at all in the most extreme seasons. The moisture is simply retained and utilized, perhaps 40 or 50 per cent. only being thrown off, as against 80 per cent. for the naked and unbroken field. And the specifically mulched surface retains abundant moisture always, the surplus penetrating deeply, when it falls, and capillary attraction slowly but steadily bringing it to the surface, so protected, for months afterward. Equally striking is the retention of moisture in the woodlands. Every condition requisite to the penetration of the earth by the falling rain, and to its subsequent return to the surface as wanted, is more decisively afforded by the dense forest than by the most skillful mulching in cultivation.

The permanence of woodland springs and the slow but steady flow of forest streams are familiar facts; and the change which absolute removal of the forest makes on any surface of the Central States is very striking. Denudation of the uplands of central New York or New England has already worked serious evils, greatly reducing the fertility of exposed lands. Similar results have been felt in Germany, and efforts to restore forests to these denuded tracts are found to encounter almost insuperable difficulties. The increased severity of the winds, and the caustic and absorbent character of these winds at very low or high temperatures, often destroys an incipient growth of forest-trees, which would have been safe if protected. Some such difficulties may very likely be encountered in planting on the plains, but that they are not insuperable may be inferred from the fact that in Germany, as in New England, something of the same difficulty exists in restoring forests to tracts known to have been originally clothed with a heavy growth of trees. The growth of forests, in nature, is the slow work of centuries, and special causes of injury, resulting from man's agency, steadily invade and diminish these primeval growths. The most constant danger on this continent is from fires, and the savage tribes are

as destructive in this respect as the civilized races, who have some care to restore what is by accident or intention destroyed. In the Eastern and Central States of the Union the great obstacle to easy settlement was the heavy forest, but at the border of the plains the new necessity is to build up what our habit has been to wastefully cut away. But the power of associated effort, of legislation, and of public opinion is fully equal to the emergency. There is no natural obstacle so great as to be insuperable, and particularly in the climate we find more to favor than was expected. In the soil there is also the most decisive evidence of adaption to forest growths, if we can only secure the presence of a fair proportion of moisture.

It can scarcely be doubted that forests are the order of nature for the amelioration of both soils and climates in the temperate latitudes. They distribute and retain the water which, though it may fall in sufficient profusion, is wasted in the sudden flow from a dry and bare surface. They secure also such permeation of the surface as is essential to the decomposition of its elements, and to the formation of the soluble products required in the nutrition of both plants and animals. Forest-soils are always rich; in those of the Central and most of the Eastern States nothing could exceed the diversity of adaptation to valuable products in cultivation. Inequality of elements and irregularity of productiveness are the usual characteristics of the soils of open plains; and a belt of heavy timber of deciduous trees, even if lying beside the richest western prairie, is found by the settler to exceed the prairie in productive capacity. This is a direct consequence of the diffusive and permeating power of the trees themselves; not a condition created by original advantages. Such heavy timber-soils will produce one-half more of corn or wheat, in most cases, than the prairie-soil lying immediately beside them. On the thin and sandy soils of the Atlantic sea-board the pine or other evergreen alone will grow; the intrinsic deficiency of mineral elements being beyond all power of correction. But even here the surface-soils were for a time highly productive, when the primeval growth of pines was first cut away; and now the only renovation possible without undue expense is through a renewed growth of pines. No spot of the plains so far identified has soils intrinsically as thin, inferior, and deficient as many of those that lie near the Atlantic coast from New Jersey to Georgia.

CITY MILK SUPPLY.

The milk supply of our cities is a subject of rapidly increasing importance not only to the consumer, but also to the agricultural regions which are being called on to furnish this staple of food. It is but about thirty years since our largest city commenced to receive milk regularly by rail, and twelve years ago its longest line of milk supply did not extend one hundred and fifty miles. Now New York receives daily from Rutland, Vermont, distant two hundred and forty-one miles, and from Pittsfield, Massachusetts, distant one hundred and sixty-seven miles on another route. Three years ago, Saint Louis, with a population of 310,000, obtained all its supply from its suburbs; now an estimated proportion of one-eighth of its supply is received by rail from distances up to ninty-five miles.

ADULTERATED MILK.

In view of the fact that the trade in fresh country milk for the single market of New York represented, in 1871, a yearly gross income to producers of $4,170,000, while the entire expenditure for city consumption exceeded $15,000,000, it will be perceived that fraudulent and deleterious enlargements of the volume of supply seriously affect the interests of agriculturists while bearing more directly on the consumers. As concerning the latter class, the adulteration of milk is attracting increasing solicitude in the larger cities of our own country as well as those of Europe. Milk inspectors and chemists, acting under direction of boards of health, have repeatedly called attention to the current depreciation of this important article of human food, and the injuries resulting to the public health, especially in increase of infant mortality. The ills of adulteration fall most heavily on the poorer classes who constitute the mass of city population; but medical testimony has shown that they affect the young life of the higher ranks of society to a much greater extent than is commonly understood. The apathy consequent on an imperfect appreciation of these evils has much impeded the execution of State and city laws concerning watered and impure milk. Experience has also shown that a common tendency has been to embarrass the statute by unwise qualifications. Boston, a pioneer in the matter of milk inspection, tried the proviso of "guilty knowledge" on the part of sellers at intervals of several years, and the results induced the State legislature to return in 1869 to the unqualified liability of the person selling or intending to sell, with heavy penalties for infringements of the law.

ACTION OF THE PRESS.

London is at the present time suffering under a like qualification affecting the milk clause of the food-adulteration act, passed somewhat hurriedly at the close of the parliamentary session in 1872, but the defects of this statute have been in some measure remedied by journalistic vigilance. One periodical publishes not only names of venders of depreciated milk, but also lists, revised monthly, of venders of the genuine article, and the combined action of law and the public press is having a visible effect in that vast metropolis, which for generations has experienced the injuries of adulteration. It is but a few months since the British Medical Journal published the results of an investigation into the character of the milk furnished to London hospitals, showing that the supply of the three largest, Guy's, St. Thomas's, and St. Bartholomew's, was very largely depreciated, that of the latter being nearly one-half water and one-half milk.

A marked instance of the power which a leading journal can exert in exposing to general notice abuses affecting the public welfare was exhibited in the issue of the New York Tribune for May 21, 1872, containing material which had been collected during several days by a corps of employés of that paper, assisted by a few city officials. These employés visited the depots of milk-receipt at railroad termini in New York and Jersey City, stores of milk dealers, and a portion of the "swill-milk" stables of Brooklyn and vicinity. At the depot of the Erie road, in Jersey City, the depot of largest supply, the milk was delivered between midnight and 4 a. m. Specials sent to this point reported that watering was freely carried on while the milkmen were crossing in the ferry-boat to New York, and additions of salt, saleratus, chalk, &c., were observed. Samples purchased of thirty-four named venders

were afterward subjected to chemical tests. In all these cases the milk had been skimmed before receiving liberal additions of water, and in seven or eight of the samples was found "a large amount of salts, showing adulteration by foreign substances." The reporter who visited the depot in Forty-eighth street, New York, the point of next largest receipt, having disguised himself as a milk-dealer's assistant, witnessed the pouring of milk into large receivers containing water, and obtained samples from sixty-eight named vènders. The milk in all these cases had been much skimmed before watering, some of the samples showing scarce a trace of the buttery substance of the original milk. In Brooklyn and vicinity, twelve swill-milk stables were visited, containing at the time over one hundred and fifty cows, the number per stable ranging from three to thirty-six, excepting in two, which had been emptied by distemper. Bad ventilation and the grossest filth were the general rule. Milk odorous with the smell of distillery-slops, and drawn into dirty vessels from unclean animals, was being made ready for conveyance in wagons which stood by, bearing in large letters the labels of "Pure Country Milk," "Pure Long Island Milk," &c.

In New York itself, where the feeding of distillery-swill for milk was formerly carried on to a most alarming extent, this nuisance is now mostly abated. The report of the board of health for 1870 says that, so far as is known to the board, there are no milch cows in that city fed on distillery-swill or other deleterious substance.

SUBSTITUTION OF CONDENSED MILK.

In view of the prevalence of depreciated milk in our large cities, recourse has been recommended to the use of condensed milk, particularly the "plain condensed," or milk condensed without addition of sugar. A late report of Dr. C. F. Chandler, chemist to the New York board of health, showed that large amounts of an excellent article of this description were used by various hospitals and charitable institutions of that city. [Report of this department for 1871, page 183.] But the necessity of exercising care in selecting an approved brand is illustrated by his statement in the report of the board for 1870, giving the following analyses of good milk of average quality, the same article condensed "plain," and plain condensed milk sold by a certain New York company:

	Pure milk.	Pure milk condensed.	Condensed milk sold by a New York company.
	Per cent.	*Per cent.*	*Per cent.*
Butter	4.00	16.00	1.75
Caseine	4.00	16.00	15.80
Sugar	5.00	20.00	18.90
Salts	0.65	2.60	2.21
Water	86.35	45.40	61.34
	100.00	100.00	100.00

In the latter case there remained not more than one-eighth of the butter contained in the original milk, seven-eighths having been skimmed off and sold for cream. He adds: "It is a notorious fact that most of the condensed-milk companies regularly send cream to the New York market."

Analyses of samples of the plain condensed milk of several companies, presented by Dr. Chandler in May, 1872, are as follows:

	American.	Borden.	Rockland.	Eagle.	Accepted standard of condensed milk.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Butter	13.74	11.39	11.67	11.77	13.12
Caseine	14.12	12.96	12.63	13.03	14.44
Sugar	17.24	14.12	13.89	14.38	16.30
Salts	2.64	2.30	2.24	2.36	2.60
Water	52.26	59.23	59.57	58.46	53.54
	100.00	100.00	100.00	100.00	100.00

AVERAGE ADULTERATION, AND ITS EFFECT ON PRICES.

It is calculated by Dr. Chandler, from long-continued investigation, that the milk supply of New York and Brooklyn receives, on an average, one quart of water to every three quarts of pure milk before reaching consumers. It cannot be otherwise than that this artificial extension of supply should depreciate prices obtained by producers. Recent tabular statements, published by milk associations concerned in the New York market, go to show that the average net price obtained by farmers shipping to that city had fallen fully one cent per quart during the three years from 1869 to 1871, inclusive. Reports for 1871, received by the Department, indicate the total receipts by rail during that year, for the city of New York and vicinity, to have exceeded 27,800,000 gallons. With the addition of water in the proportion of one to three before delivery to consumers, we find milk-growers deprived of a business which would return to them $1,390,000 yearly, at an average first price of 15 cents per gallon, city consumers, on the other hand, paying more than $3,700,000 annually for water; and these losses are increasing. This calculation does not touch the supply of swill-milk from the city suburbs, stated at about 1,800 gallons daily in 1872. Putting aside extension by water, this deleterious stuff causes an additional forestalling of country production to the amount of 657,000 gallons of milk yearly, an item of comparatively small consequence to the great milk-growing region, but quite significant in city health reports. It has been stated that, in 1841, swill-fed milk constituted nearly the whole supply of New York.

SUPPLY BY RAIL.

The statistics of milk supply by rail include the most important relations between the producer and the consumer. This medium of conveyance, in opening a market to regions hitherto comparatively isolated, has compelled dairy-farmers to study more carefully questions of feeding and the home management of milk, and has made charges of transportation and handling by middle-men and city milkmen points of constantly growing consequence. Some material concerning prices obtained by shippers in different sections of the country, cost of transportation, and methods of management, has been given in the reports of the Department for 1870 and 1871. The following exhibits are from correspondence with milk producers, railroad officials, secretaries of agricultural

societies, and other parties on leading lines of milk supply, and from miscellaneous sources. In summaries of prices and charges of transportation, reduction is made to quarts, in order to a ready comparison of the trade returns of different regions.

SHIPMENTS TO NEW YORK.

In the New York trade the milk is shipped by the producers at the country stations on milk-cars fitted up and cared for by the railroad company. The farmer furnishes his own cans, each of ten gallons' capacity, and costing him $6 or more. The shipments are to dealers who have contracted to pay a certain price for a designated season, or they are on commission. Freight charges are paid by dealers at the city terminus. On the Erie road, the line of largest shipment, and on the New York and Oswego Midland, the charge is 55 cents per can, for all distances; on other roads, 60 cents per can, excepting shipments from points on the Harlem Extension, one hundred and thirty miles to two hundred and forty-one miles from New York, which are charged 80 cents per can. The following summary of average prices received by farmers at stations of shipment is derived from replies to circulars addressed to station-agents and others on the various lines of supply: At points distant about thirty miles from New York, 3½ cents per quart in summer, 5½ cents in winter; at fifty miles, 3 cents in summer, 5 cents in winter; at one hundred and fifty miles to one hundred and seventy miles, on the Housatonic route, 3 cents in summer, 4 cents in winter; at one hundred and fifty miles to two hundred and forty miles on the Harlem Extension, 2¼ cents in summer, 4 cents in winter. The averages of the regions of largest shipment are very nearly 3 cents in summer and 5 cents in winter. Taking the whole supply, the cost per quart laid down at the depots in New York City ranges from 4½ cents in summer and 6 cents in winter, for receipts from points distant one hundred and fifty miles or more, to 5 cents in summer and 7 cents in winter for receipts from distances of about thirty miles.

The following will give an idea of variations in average prices at different points:

Points of shipment.	Distance from New York.	Price per quart.		Freight per quart.	Points of shipment.	Distance from New York.	Price per quart.		Freight per quart.
		Summer.	Winter.				Summer.	Winter.	
	Miles	*Cents.*	*Cents.*	*Cents.*		*Miles.*	*Cents.*	*Cents.*	*Cents.*
Chappaqua, N. Y	33	3½	5½	1½	Attlebury, N. Y	97	3	5	1½
Croton Falls, N. Y	48	3½	5	1½	Stissing, N. Y	96	3	5	1½
Monroe, N. Y	50	3	5	1⅜	Pine Plains, N. Y	100	3	5	1½
Chester, N. Y	55	3¼	4¾	1⅜	Husted, N. Y	108	3½	4¾	1½
Cornwall, N. Y	56	3	5	1⅜	Stephentown, N. Y	170	2¼	4½	2
Goshen, N. Y	60	3	5	1⅜	Canaan, Conn	130	3	4	1½
Lagrange, N. Y	74	3½	5	1½	Sheffield, Mass	136	3	5	1½
Billings, N. Y	76	3	4½	1½	Pittsfield, Mass	167	3	4	1½
Moore's Mills, N. Y	78	3¼	4⅜	1½	East Dorset, Vt	216	2½	4	2
Verbank, N. Y	81	3	4½	1½	Clarendon, Vt	235	2½	4	2
Millbrook, N. Y	86	3	4½	1½	Rutland, Vt	241	2¼	4½	2

The correspondent at Goshen reports prices at 3, 4, and 5 cents, for periods of four months, respectively. Mr. Orrin Wakeman, of Millerton, New York, informs us that for the first few years after the completion of the New York and Harlem road, which took place in 1851, the

freight-charge was 30 cents per can, or $\frac{3}{4}$ cent per quart. It was afterward raised to 40 cents per can, and for the last ten or twelve years the charge has been, as at present, 60 cents per can. From 1851 to 1860 farmers received $2\frac{1}{2}$ cents per quart in summer and $3\frac{1}{2}$ cents in winter, namely, October 1 to April 1, and from the early part of 1861, generally speaking, $3\frac{1}{2}$ cents in summer and 5 to 6 cents in winter. Shipments from Millerton are by several lines of rail. The correspondent at Rutland, Vermont, states that the milk-car leaves that station at five minutes past 9 a. m., and is due in New York at about half past 12 at night. The station-agent at Clarendon, Vermont, writes that the business there has but just commenced, and is increasing, and adds: "Milk, at present prices, is doing about 35 per cent. better than butter or cheese. The latter heretofore has had the lead in dairy matters." The business of milk shipment from Vermont is of recent date. The report from Canaan, Connecticut, is for shipments by the Housatonic road.

Mr. Otis T. Bedell, president of the United Farmers' Milk Company, doing business in New York, writes that the retail prices of milk in that city from 1869 to 1871, inclusive, were 10 cents per quart in summer and 12 cents in winter, and that during the summer of 1872 the price was brought down to 8 cents. The secretary of the Iron Clad Can Company writes that the summer prices of 1872 varied from 8 cents to 10 cents per quart, averaging 9 cents.

Reports received from freight agents and superintendents give the following as the shipments over the several named roads above for the year ending December 31, 1871: Erie, 11,733,500 gallons, including 306,092 gallons of cream and 14,217 gallons of condensed milk; New York and New Haven, 3,144,330 gallons; New York Central and Hudson River, 1,925,557 gallons; Central New Jersey, 543,770 gallons; South Side Long Island, 359,944 gallons; United Railroads of New Jersey, 365 cans 3650 gal per month. No report has been received from the New York and Harlem. Recent estimates have placed the shipments on that road at six-sevenths of the amount shipped on the Erie, which, on the above basis, would show about 10,057,280 gallons for 1871, making the total receipts in New York and vicinity, in 1871, by the named roads, over 27,800,000 gallons. Receipts by the New York and New Haven road were (excepting three stations) from Connecticut and Massachusetts, and included $1,858,497\frac{1}{2}$ gallons by the Housatonic road and $581,487\frac{1}{2}$ gallons by the Naugatuck.

History of shipments by the Erie road.—In 1843, soon after the opening of the Erie road, it carried 795,376 gallons; in 1851, 3,152,639 gallons; in 1861, (year ending June 30,) 6,103,652 gallons; in 1871, 11,733,500 gallons; in 1872, 11,720,580 gallons, including 332,340 gallons of cream. Mr. Emmett Moore, milk agent of the road, writes that the business has increased about 10 per cent. yearly, on an average, for the last ten years. The apparent diminution in 1872 arose from the transfer of shipments of the Middletown, Unionville and Water Gap road and the New York and Oswego Midland to independent accounts of the latter corporation. The freight charge on the Erie line being 55 cents per can, or $5\frac{1}{2}$ cents per gallon for milk and 60 cents per can for cream, it will be seen that the gross income from transportation of milk and cream on that road, in 1872, amounted to $646,293.60. Eighty miles is the extreme distance of shipment.

Orange County milk.—Orange County, New York, has long been prominent as a milk-producing section. Several short lines of rail traverse it and swell the volume of transportation over main roads. The follow-

ing shipments, reported for 1871, by three of these branch roads will serve as a very partial illustration of the importance of the milk business in that county. From Five Points, on the Warwick Valley road, ten miles in extent, 1,831,930 gallons, including 87,790 gallons of cream; by the Goshen and Deckertown road, twelve miles in length and receiving from distances of two and a half miles on either side, 1,356,000 gallons; by the Middletown, Unionville and Water Gap road, fourteen miles long, 1,117,307 gallons.

Miscellaneous particulars.—The New York and Oswego Midland (including by lease the New Jersey Midland) commenced transporting milk to New York over its own line in July, 1872, and for the last six months of that year shipped 955,909 gallons, averaging about 5,224 gallons per day; extreme distance of shipment ninety-eight miles. H. M. Weed, general freight agent, writes that the shipments will be increased during 1873 to fully 15,000 gallons per day, through enlarged facilities for transportation, and adds: "The transportation of milk by rail to New York is a very profitable business, although attended with great risk. Our train must be in New York by 2 a. m., otherwise milkmen are likely to refuse to receive; in that case we lose our freight and have to pay for milk. We can put about 200 cans (8,000 gallons) in a car; each car will net the company about $100.

The Dutchess and Columbia road, traversing Dutchess County, New York, from Millerton to Dutchess Junction, reports for the year ending December 1, 1872, 1,598,693 gallons, including condensed milk to the amount of 31,096 gallons from Millbrook, and 12,836 gallons from Clove Junction. The Connecticut Western road, touching the New York State-line at Millerton, commenced running its milk-train April 1, 1872, and during the remainder of that year carried from stations between Winsted, Connecticut, and Millerton, New York, 328,785 gallons. From points on the Harlem Extension from West Lebanon, New York, to Rutland, Vermont, inclusive, there were shipped during the year ending November 30, 1872, 943,410 gallons, nearly one-third of the amount being from the stations of Rutland, Clarendon, Wallingford, and Danby, Vermont.

Mr. Eli Smith, of Sheffield, Massachusetts, on the Housatonic road, writes that this station sends more milk to New York than any other station on the road, West Cornwall, Connecticut, coming next in size of shipment. From the former point 242,750 gallons were shipped in 1872. T. S. Gold, of West Cornwall, secretary of the Connecticut State Board of Agriculture, reports shipments from that point in 1872 at 241,165 gallons. Average net price for the six months commencing April 1, 3 cents per quart, not including a small fraction, probably enough to cover commission; for the six winter months, 4¼ cents over commission.

SHIPMENTS TO PHILADELPHIA.

Mr. Benjamin T. Lovett, secretary of the Dairymen's Association of Philadelphia and Camden, writes that the receipts of milk in Philadelphia are chiefly by rail and from within forty miles of distance, the limit of shipment being about fifty miles; a small percentage of the total receipt is by wagons. He gives the following statement of receipts by the several named roads: By the North Pennsylvania road, for the year ending October 31, 1871, 2,498,438 gallons; the Philadelphia and Reading road, for the nine months ending September 30, 1872, 2,105,080 gallons; the Philadelphia, Wilmington and Baltimore road, for the year

ending October 31, 1872, 765,580 gallons; the Philadelphia and Baltimore Central road, for the nine months ending October 31, 1872, 462,500 gallons; the West Chester and Philadelphia road, for the year ending at the same date, 488,500 gallons; the Pennsylvania Central road, for five months ending August 31, 1872, 283,835 gallons. The city retail prices per quart are, in summer, 8 cents; in winter, 10 cents.

Mr. Lovett reports the prices paid by dairymen to farmers in 1872 as follows: From January 1 to March 31, $5\frac{1}{2}$ cents per quart; for April, 5 cents; from May 1 to October 31, 4 cents; from November 1 to December 31, $5\frac{1}{2}$ to 6 cents. An analysis of this statement shows 4 cents for the six months ending October 31, and an average of $5\frac{1}{2}$ cents for the other months. Replies to inquiries made by the Department bring out the fact that the rating of the cans is very generally by dry measure. Taking this into consideration and deducting freight-charges of $\frac{3}{8}$ cent per quart, paid by the farmer, net prices to producers at stations of shipment are exhibited at about $3\frac{1}{10}$ cents for the six summer months, and an average of $4\frac{2}{5}$ cents for the remainder of the year.

The general freight agent of the Philadelphia and Reading road informs us that the receipts of milk at its Philadelphia depot in 1871 amounted to 2,552,041 gallons. Freight rates, $\frac{3}{8}$ cent per quart, or, more precisely, 8, 12, and 15 cents for cans of 5 gallons, $7\frac{1}{2}$ gallons, and 10 gallons, respectively. Shippers are required to prepay freight.

Reports from correspondents along this route indicate that the cans are most commonly $7\frac{1}{2}$ gallons in capacity.

The general freight agent of the United Railroads of New Jersey writes that the milk traffic on these lines of road has been so small that no special record of it has been kept, and that the agricultural regions through which they pass are almost exclusively devoted to truck-farming. An effort is to be made to stimulate the traffic on some of the new branch roads; the proposed rates of freight are from $1\frac{1}{2}$ cents per gallon for distances under twenty miles, up to 3 cents per gallon for distances over thirty miles.

SHIPMENTS TO BOSTON.

The business of supply for the Boston market is chiefly managed by contractors, who, conferring with the producers just before the commencement of each season of six months, fix the price per can at the farmer's door, and assume provision of cans, collection of the milk, and transportation by rail. The contractor leases a car of the railroad at a fixed yearly rent; the actual cost of transportation is therefore to be deduced from the average amount of milk carried. The capacity of the milk-car is stated at 1,000 cans, the capacity of the cans being, on some routes, the Fitchburgh road for example, $8\frac{1}{2}$ quarts; on other roads, as the Boston and Albany, $9\frac{1}{2}$ to $9\frac{5}{8}$ quarts. Average amounts carried on established routes, 750 cans and upward. The yearly rental per car has ranged from $5,000 for a running distance of twenty miles to $9,000 for about fifty miles.

A careful summary of reports received from points along the chief lines of supply presents the following exhibit of prices received by the farmer at his door, clear of charges for collection of milk and rail transportation, as well as cost of cans: At distances of about twenty miles from the city, summer price, April 1 to October 1, $3\frac{3}{4}$ cents per quart; winter price, not over $4\frac{2}{5}$ cents. Concord, twenty miles from Boston, reports $4\frac{5}{17}$ cents in winter. At distances of twenty-five to forty miles, summer prices, $3\frac{1}{2}$ cents to $3\frac{1}{5}$ cents; winter, $4\frac{1}{3}$ to $4\frac{1}{8}$ cents generally

diminishing as the distance increases. For larger distances, up to fifty-eight miles, the extreme of shipment, summer prices generally fall within $3\frac{1}{5}$ cents and winter prices within four cents; as exceptions, Mason, South Lyndeborough, and New Ipswich, in New Hampshire, report winter prices of $4\frac{1}{3}$ to $4\frac{1}{2}$ cents, as in the season of 1870–'71.

At distances of ten to twelve miles from Boston the milk is commonly taken up by milkmen who carry to the city in wagons. Prices at the farmer's door $4\frac{1}{8}$ cents in summer and about 5 cents in winter. The correspondent at Woburn, ten miles from Boston, writes that retailers pay at the car in the city 40 cents per can of $8\frac{1}{2}$ quarts in summer, and 50 cents in winter, and that he is acquainted with farmers raising 40 cans per day and delivering to retailers in the city at these prices. In that vicinity 5 cents per can have represented the cost of collection and transportation either by wagon or rail.

The conditions of first prices and charges of transportation affecting the bulk of supply are presented in the following table, the two last columns giving the cost of the milk laid down at the depot in Boston:

Distance of points of shipment from Boston.	Price per quart at farmer's door.		Cost of collecting, per quart.	Cost of rail transportation per qt. (car rent.)	Cost laid down in Boston, per quart.	
	Summer.	Winter.			Summer.	Winter.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
20 miles	3.75	4.4	0.4	.25	4.4	5.05
25 to 40 miles	3.5 to 3.2	4.33 to 4.12	.4	.33 to .5	4.23 to 3.95	5.06 to 4.97
40 to 58 miles	3.2	4	.4	.5	4.1	4.9

Putting aside shipments of twelve to fifteen miles, $4\frac{1}{2}$ cents in summer and 5 cents in winter per quart will fully cover the cost of the milk when laid down at the depot in Boston. Shipments by the Concord car do not cost over $4\frac{1}{4}$ cents in summer. Amounts carried by this car are reported at about 1,000 cans, or 8,500 quarts, daily. City retail prices are 8 cents in summer, 9 cents in winter.

During the winter of 1870–'71 prices throughout the greater part of the milk-shipping region ruled 3 cents to 5 cents higher per can than of late, and a controversy has prevailed since that time between producers and contractors on this point. The Massachusetts and New Hampshire Milk Producers' Association, an organization of several years' standing, has endeavored by various measures to effect a return to higher prices. A number of farmers in the Concord section, which, from its large production of milk, feels quite sensibly the reduction of 5 cents per can, endeavored to make a direct arrangement with the Fitchburgh road for carriage of their milk, the amount thus offered for conveyance reaching 200 cans per day. A committee of the association having conferred with the directors of the road, the latter offered the applicants the same terms as those held with the contractor, namely, a car on lease at $5,000 per year, and, as an alternative, conveyance by local freight-train at 6 cents per can. The committee reported that neither alternative gave the petitioners a practicable opportunity; the first required the lease of a whole car, and the second was impracticable, since the train had no regular running time.

The legislature of Massachusetts, a little more than twelve years ago, passed an act requiring the use of sealed cans, showing capacity in wine quarts, under penalty of fine in case of neglect. This law is generally observed in that State, but an exception appears in the report from the

Harvard correspondent, who says: "Not a single sealed can has been left with me lately; I do not think I have seen one for five years, certainly not for two years. The law is a dead letter in this vicinity." He complains that this illegal usage operates, through irregularity in size of cans, to reduce the price received by the farmer to a rate below the nominal one. On New Hampshire portions of the routes, South Lyndeborough and Amherst report that few of the cans are sealed, other points reporting sealed cans.

In May, 1872, the Massachusetts law respecting adulteration of milk was made still more stringent, and a clause was inserted making the seller of milk which has been skimmed or partly skimmed liable to a fine of not less than $20 for the first offense, and not less than $50 for each subsequent offense.

SHIPMENTS TO CHICAGO.

Comparatively little milk is received in Chicago from points distant more than fifty miles from that city. On the Chicago and Northwestern Railway fifty-three miles is reported as the extreme distance of regular milk shipment, and on the Chicago, Burlington and Quincy road seventy-seven miles. Producers ship to city dealers, the former paying freight and generally furnishing cans.

Dr. J. H. Rauch, of the Chicago board of health, writes that during the six winter months of 1871-'72 city dealers paid farmers 4⅛ cents per quart and retailed at 7 cents; during the summer of 1872 farmers received 3⅛ cents, city retailers obtaining 6 cents. Farmers had received in the preceding year 5 cents per quart, gross, in winter, and 3¼ cents in summer; city retail prices, 8 cents and 7 cents. To show net receipts by farmers at points of shipment freight-charges must be deducted from gross prices. Reports received by the Department from the Chicago and Northwestern Railway give transportation charges per can of 8 gallons, for distances reaching twenty miles, 16 cents; for twenty to forty miles, 20 cents; for more than forty miles, 24 cents. The Chicago, Burlington and Quincy road reports 15 cents per eight gallons up to about forty miles, 20 cents for fifty miles, and 25 cents for seventy-five miles. A summary of information on net prices received in 1872 by farmers at country stations shows 2½ cents in summer and 3½ cents in winter, at points of largest shipment, correspondents at other points reporting variations reaching ¼ cent, in some cases more.

Dr. Rauch offers a statement of the daily milk receipts of the city in 1872, which, with some modification in the first two items, is as follows: By the Chicago and Northwestern Railway 10,730 gallons; Chicago, Burlington and Quincy, 2,322 gallons; Illinois Central, 600 gallons; Rock Island, 300 gallons; Chicago, Danville and Vincennes, 160 gallons—making the daily receipts by rail 14,112 gallons; 6,000 gallons from cows kept in the city swell the receipts to 20,112 gallons daily, or 7,340,880 gallons for the year. He adds that the supply by rail has increased fully one-third over that of 1871, owing to increase of population and the removal by the board of many of the city cow-stables. Two-thirds of the cows kept in the city are swill-fed. The character of the city milk supply is claimed to be comparatively good; water is the only means of adulteration used, as far as is discovered.

C. C. Wheeler, general freight agent of the Chicago and Northwestern Railway, reports the receipts of milk by that road in 1871 at 2,960,649 gallons. February was the month of smallest receipts, and August that of the largest; their respective amounts being 193,082 gallons and

302,604 gallons. The receipts for 1872 were 3,916,328 gallons, showing an increase of 32 per cent. over those of 1871. February was the month of smallest receipt; July that of the largest. Dundee, forty-seven miles from Chicago, furnished more than one-quarter of the amounts of the two years. The freight auditor of the Chicago, Burlington and Quincy road reports receipts by that road in Chicago for 1872 at 847,608 gallons.

Mr. W. S. Weightman, of Huntley Station, fifty-five miles from Chicago, writes that producers incur much expense through improper management in the matter of cans, especially in delays in return of cans. Shippers find it necessary to provide three or four sets of cans, and often five or six sets; thus an outlay of $20 to $25 is required to secure the regular daily shipment of one can of milk. In cases within his knowledge, loss of cans has averaged one can per year for each daily shipment of one can. Wear of cans is rendered unnecessarily large by the rough and careless handling of railroad employés.

Mr. V. Fredenhagen, of Downer's Grove, twenty-two miles from Chicago, writes that dealers generally agree to furnish one-half of the cans, but even under this arrangement farmers are often obliged to purchase an extra supply on account of detention of cans. He complains that, through want of sufficient police surveillance at city depots, many cans are stolen, often full of milk. As to retail prices, while milk of good quality brought six and seven cents, swill-fed and adulterated milk sold at lower rates.

SHIPMENTS TO ST. LOUIS.

The first regular shipments of milk to St. Louis were from the neighboring counties of Saint Charles and Warren, on the line of the North Missouri road, in the latter part of 1870. Colonel N. J. Colman, of Colman's Rural World, writes that the city receipts by rail now reach an estimated proportion of one-eighth of its total supply. "The business by rail is still in its infancy, owing to the large number of swill-milk dairies in the immediate vicinity, the owners of which are able to purchase brewers' grains at 2 cents per bushel, and distillery-slops at a proportionate price. Perhaps no city in the United States is so favorably situated for receiving its milk-supply directly from the country. Numerous railroads, radiating from Saint Louis in every direction, penetrate sections of country admirably adapted to milk-production." City retail prices are 5 cents to 8 cents per quart throughout the year. [In 1870 the price was 10 cents per quart.]

Railroad returns indicate ninety-five miles as the extreme distance of shipment. Price per quart generally received by farmers at stations of shipment, clear of freight, $3\frac{1}{8}$ cents throughout the year. Freight-charges on the different roads range from $\frac{3}{8}$ cent to $\frac{1}{2}$ cent, without regard to distance. The correspondent at Sandoval, Illinois, sixty miles from Saint Louis, reports prices averaging fully $\frac{3}{8}$ cent lower, and adds that the cans contain more than their nominal measure. Only about six months had elapsed since the commencement of shipments, which would not exceed on an average 30 gallons per day.

Shipments by the Ohio and Mississippi Railway for 1871 amounted to 157,356 gallons, all from stations in Illinois. Freight $\frac{1}{2}$ cent per quart.

OTHER MARKETS.

Theophilus Wilson, secretary of the Hamilton County (Ohio) Agricultural Society, informs us that very little of the milk-supply of Cin-

cinnati is received by rail. Dairymen sell by beer-measure, while many of the grocers and dealers sell by wine-measure. Prices are the same for summer and winter. Hotels and milk-dealers pay 5 cents to 6¼ cents per quart. Retail price of milk, "dry-fed," 10 cents per quart; "slop-fed," 8 cents per quart. There are about two hundred and fifty dairies in and around Cincinnati, averaging thirty cows and 40 gallons of milk per day. Probably one-half of the dairymen use "dry feed," including brewers' grains, corn-meal, bran and shorts, and sheaf-oats, the other half using still-slops, refuse from starch-factories, with oil-cake, &c. Many wealthy families in the city and immediate suburbs keep their own cows.

G. A. Martin, agricultural editor of the Commercial Advertiser, Buffalo, New York, writes that the prices received by farmers at stations fourteen to twenty miles from that city have been as follows: From May 1 to September 1, 2½ cents per quart; from September 1 to November 1, 3 cents; from November 1 to May 1, 3½ cents. Milk is forwarded by rail from all points distant more than five miles from the city. Freight-charges are paid by the city dealers buying from farmers and retailing to consumers, and amount to 1 cent per gallon for every twenty miles of distance. The city retail price per quart, for the six months commencing May 1, has been 5 cents; for the six months following, 6 cents. Producers and dealers sell by wine-measure. Erie, Chatauqua, and Cattaraugus Counties are peculiarly adapted to dairying, which is, conse quently, their leading agricultural interest; they furnish the city with an abundant supply, generally of excellent character. The Erie County Co-operative Milk Association, organized by dairymen in Alden and Aurora Townships, opened a depot in Buffalo May 1, 1872, for the purpose of supplying milk directly to consumers. The sales commenced with 50 gallons per day, and soon reached 600 gallons daily. The association is now in a prosperous condition.

Mr. F. B. Shalters, of Reading, Pennsylvania, secretary of the Berks County Agricultural Society, writes that that city receives all its milk from farms within a distance of five miles. Retail prices, 8 cents in summer and 10 cents in winter, per quart; wine-measure only is used. During the summer the receipts are increased about 6,000 gallons per week, for the numerous ice-cream factories, some of which are very large establishments, operated by steam. The factories pay 20 cents per gallon, delivered. Pottsville receives about 1,000 gallons of milk, weekly, by the Philadelphia and Reading road, and the Lebanon Valley branch takes about 240 gallons per week, from the west part of the county, to Harrisburgh.

In the city of Washington small amounts of milk are received, daily, by the Baltimore and Ohio, and the Orange, Alexandria and Manassas roads, but the demand for country milk is urgent, and the business by rail is increasing.

The Piedmont Milk and Produce Association, receiving milk on the Orange, Alexandria and Manassas road, from points in Virginia up to about eighty miles distance from Washington, commenced operations in February, 1872, and during the summer of that year received an estimated average of 250 gallons daily; winter receipts up to the middle of January, 1873, averaged not over 80 gallons per day; total receipts for the first ten months, 36,520 gallons. Sales are on commission; producers furnish cans, 5-gallon and 10-gallon sizes; freight is paid at the city terminus, and is charged to the farmers' account with the association. Gross prices to the producer, in summer, 5 cents per quart; in

winter, 6 cents. Charges to be deducted are as follows, reckoned per can of 10 gallons:

Freight, for distances reaching thirty-five miles, 35 cents; over forty miles, 40 cents; cartage, 3 cents; commission, 10 per cent. This exhibit gives the net prices in summer, for shipments from points distant not more than thirty-five miles from market, at about $3\frac{1}{2}$ cents per quart, and for shipments of greater distance $3\frac{1}{3}$ cents; net prices in winter, $4\frac{1}{2}$ and $4\frac{1}{3}$ cents. The association insists that there shall be no skimming of the milk, and repeated tests with the lactometer have proved that the requirement is well observed. Retail prices in Washington are 10 cents per quart in summer and 12 cents in winter.

In 1871 an effort was made to establish a milk business on the line of the Washington and Ohio Railroad, penetrating the rich pastoral section of Loudoun County, but the enterprise resulted in failure, which is stated to have been caused by inability to secure proper facilities for transportation.

MANAGEMENT OF MILK ON THE FARM.

One of the greatest obstacles to success in new enterprises of shipment is the difficulty of impressing producers with the absolute necessity of perfect cleanliness in milking, and care of milk vessels, and of establishing themselves in accurate methods of cooling. The looser management which may suffice for milk not subjected to transportation will not suffice for milk which is to be carried long distances and made liable to considerable delay before consumption. Shippers who are not careful to inform themselves fully on points of management are often surprised, if not indignant, at having milk returned on their hands as sour which left their hands apparently in good condition, while their neighbors meet with no such misadventure. Return of milk sometimes occurs through efforts of dealers to relieve themselves of a surplus; on the other hand it is frequently the result of improper management on the farm. And when a producer has once established a reputation as a prompt, skillful dairyman, his account with the dealer generally suffers little deduction for sour milk. Participants in new enterprises should exert themselves to diffuse among all concerned a knowledge of the requisites of the business, since the difficulties arising from ignorance in this respect tend to depreciate prices and imperil the success of the whole undertaking.

The following minutes of practice will be found suggestive, especially in new regions of shipment:

An informant at Littleton, Massachusetts, says: Our most reliable dairymen now use tin milking-vessels; wooden pails are not considered safe in respect to perfect cleanliness. Our milk-cans, $8\frac{1}{2}$ quarts in capacity, are stoppered with bungs of maple, or other close-grained wood, these being preferable to tin stoppers on account of the jamming to which the neck of the can is liable in handling by collectors, &c. The collector, in returning the cans from the train, throws them out upon the ground without stopping his wagon. The returned cans are very foul, often moldy. They are thoroughly scrubbed by hand inside, using warm water, then are scalded and rinsed, and placed bottom up on a rack out of doors to dry. The wooden stoppers are scraped and boiled; when they are offensive to the smell, lye is used in the process. At milking-time the milk is strained into the can, which is set into a vat of cold water, the milk stirred from time to time, and brought to the proper temperature for shipment. The evening's milk is left overnight

in the water and taken up with the morning's milk for the train. It is required that the cans, before forwarding, be filled, and the bungs driven down firmly on the milk. This point of complete filling is strongly insisted on by dealers, in order to prevention of injurious agitation of the milk during transportation.

In like manner with the condensed-milk companies, the Illinois Condensing Company, of Elgin, Illinois, is very precise in its rules for the guidance of parties furnishing it milk, fixing the limit of temperature of springs at different seasons of the year, &c. Its printed regulations include the following particulars: The milk must be drawn from the cow in the most cleanly manner, and strained through wire strainers into the cans, which are then to be placed, with covers removed, in a vat of cold water deep enough to come up to the height of the milk in the cans, and holding fully three times the quantity of water that there is of milk to be cooled. The milk is to be occasionally stirred while cooling. In summer, or in warm weather in spring and fall, the bath is to be spring-water, not over 52° in temperature, the stream constantly flowing in at the bottom of the vat, and out at the top, in order to carry off the warmed water. The milk is to be reduced within 45 minutes to a temperature below 58°. Night's and morning's milk must be separately cooled before mixture.

Mr. Benjamin Cox, of Elgin, writes that stirring the milk while cooling is generally advocated and practiced there by shippers to Chicago, although a few object to the stirring. The cooling-vat should have two compartments, one for night's milk, the other for morning's milk. Slats an inch in thickness are nailed at the bottom in order that the water may circulate under the cans. If no spring is accessible, cooling at the well is substituted, which method requires more care and labor. In this case, while the milk is cooling, fresh water is pumped so as to flow down the side of the vat to the bottom, afterward passing out over the top of the vat. The temperature of the milk should be brought down to 58°. No use is made of patent coolers, and seldom of ice, but the Chicago dealers use ice freely after milk is received by them. In carrying to the railroad-station the milk is covered with blankets, and, if the weather is hot, the one next the cans is wet with cold water.

Mr. A. D. Smith, of Danby, Vermont, two hundred and twenty-three miles from New York, writes to the same general effect; but in respect to maintenance of temperature during extreme hot weather in conveying milk to the train, he says that the practice is to put ice around the cans in the wagon, and some place a piece of ice in the milk. The carrying is timed so as to allow as little detention at the station as possible. The dairy-farms of that section lie on hill-slopes, and are supplied with cool, permanent springs. Two-inch plank is used for the vats. Most of the dairymen now have ice-houses, often combined with the milk-houses, the lower story for milk and the upper for ice. The railroad has recently erected large ice-houses for supply of cars, at all points of considerable shipment. In past years cheese has been the leading dairy specialty of that region. A superior quality has been maintained, and consequently the highest market-prices received. The milk business which has grown up of late has had a beneficial effect toward preserving uniformity of prices.

The managers of the Piedmont Association, of Washington City, advise shippers that the temperature of the flowing bath should not be over 54°, and that no ice should be allowed to touch the cans or be placed in the milk, as such practices, though they may seem convenient for deliveries at the train, tend to more rapid change of the milk at a

later period. For protection in the wagon it is recommended to use blankets in like manner as already stated.

With their present amount of business, common freight-cars are used for transportation, without ice. Some of the larger shippers have derived much advantage from the use of a patented cooler, which consists of two vessels, one within the other, so constructed that, by a very simple contrivance, a thin sheet of milk is made to pass rapidly in a spiral direction between two bodies of water. The cooler is readily cleansed, thus avoiding a current objection against patent coolers. During April and a part of May, 1872, the milk shipped by the president of the association, residing at Clifton, Virginia, thirty miles from the city, was nearly all sour when received in Washington, notwithstanding his endeavors to fulfill directions as to cooling. On making trial of the just-mentioned cooler the difficulty disappeared. In order to test the improvement fully, a 10-gallon can of milk, received from him in the middle of May when the weather at midday was quite warm, was left in one corner of the railroad freight-depot for three days after its arrival, without ice or other protection, remaining sweet at the close of that time. The cooler would appear to be quite similar in principle to one which received a medal from the Royal Agricultural Society of England in 1872, but the form of application is different.

Dr. S. L. Loomis, of Washington, who contributed an article on milk to the Report of 1861, and who has had considerable practical acquaintance with the business of milk shipment, in exemplifying the mistakes that sometimes occur, says that some years ago, when traveling on the line of the Harlem Railroad, and about one hundred miles from New York, he met a young farmer who had recently commenced sending milk to that city. The latter complained that while his father, whose farm was near by, had no difficulty with his shipments, he himself, though brought up in the business and now following the accustomed course, was continually having milk returned upon him. In reply, a test by thermometer was suggested, and the instrument when placed in the spring which had been relied on for cooling showed a temperature of 56°, 2° higher than the approved limit. His milk had not been properly cooled. It is important that milk after being cooled should not be subjected to alternations of temperature. Farmers should also beware of delegating care of milk to servants whose reliability and competence is not assured. Dr. Loomis adds that the conditions attending the distribution of city-fed milk in Washington are substantially the same as stated by him in 1861, and estimates that about 1,000 cows are now kept within the city limits.

SEALED CANS.

There can be no just reason for the use of one description of measure between the producer and the dealer, and another between the dealer and the consumer. Such usage is in effect a deception. It is plainly desirable that cans should be sealed, showing their capacity in standard or (in common phrase) wine measure.

ORGANIZED ASSOCIATION.

The circumstances of the milk trade point plainly to the desirability of some general organized communication between producers. Accurate and widely diffused information concerning home management and cost of production, conduct of transportation and charges of middle-men,

evidently tends, by steps however slow, to an equalization of the several contending interests involved in the business of milk shipment. Such complete information can be attained only through judicious organization.

At the annual meeting of the New York Dairymen's Association in January, 1873, Mr. X. A. Willard, the president, said that the dairy conventions of the country are chiefly attended by cheese manufacturers and others (dealers, &c.) not actually engaged in farming. The consequence is that while cheese manufacturers have become highly educated in their employment, dairy-farmers have not advanced in a proportionate degree. If farmers would come together and interchange ideas freely, many of the now-existing evils would soon disappear. Mr. T. D. Curtis, in speaking of the efforts toward better systems of marketing, urged the importance of strengthening the bonds of union among producers by the establishment of farmers' clubs in every school-district, these to be represented in town clubs, and the latter in county clubs sending delegates to State organizations.

In comparing the systems of milk-shipment pursued in different regions, there will be perceived a decided advantage in the New England system of transportation by car-contract in lessening the difference between prices to first hands and prices to consumers. This system has also brought heavy profits to contractors on the lines supplying the Boston market. Under the stimulus of the high cost of winter production, energetic efforts have been made to divert a portion of these profits to producers. For a time the project was entertained of the assumption by associated producers of the entire business of shipment up to delivery to city retailers.

Limited enterprises of associated shipment have been carried out successfully in different parts of the country. Failures have occurred, as they do in all other descriptions of business. They enforce the caution that in all such undertakings the field of operation with its local conditions should be adequately studied, and that the one person to whom must be committed the superintendence should possess the business qualification which will enable him to cope with those details which lie between the barn-yard and the city peddler's payments. Absence of such competent superintendence being the natural precursor of failure, its presence should be secured by that liberal compensation which will be in effect the truest economy. The disposal of a car-load of milk daily from a tolerably compact region of production would not appear to involve serious difficulties, granted a united sentiment among shippers and a trusty and capable manager; otherwise, the case is quite different. The variations in prices found within the same region of production of themselves evince the minuteness with which individual operators watch the sails of their enterprise, and the agent of associated shipment must have a similar appreciation of the value of "margins" and the various other particulars which constitute the interval between success and its opposite, in new regions including especially the securement of reliable railroad service.

As to enterprises involving heavy capital and extending over large areas of country, risks would obviously be increased by the more complex service and the greater distance between managers and individual stockholders. For the present a preference is indicated for undertakings of moderate dimensions, which, in succeeding, would make more feasible the success of larger operations in the future.

PROGRESS OF INDUSTRIAL EDUCATION.

All the States except Arkansas, California, Florida, Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, Oregon, and Wisconsin have sold the entire amount of land-scrip granted to them by Congress under the act of July 2, 1862. Of these, some have sold none, and others only a part. Arkansas and Florida have not yet received theirs from the Government, in consequence of their indebtedness to the Indian trust-fund, which is in the care of the Department of the Interior, and the Secretary did not feel authorized to deliver the lands while this indebtedness remained. An act has therefore been passed by Congress, approved December 13, 1872, directing the Secretary to deliver them, and they will be issued as soon as the necessary arrangements can be made. The number of acres sold by the twenty-three States which have disposed of all their scrip is about 6,120,000; the amount received from the sales is some $4,126,000; and the average price obtained per acre is about 67 cents. Some of the States are holding their lands and renting them at 6 to 8 per cent. on their estimated value, with the expectation of selling them at some future time at advanced prices.

There are now thirty-eight industrial institutions in the United States which have received the national endowment, and these are confined to thirty-five States. Louisiana and Nevada have not yet established any. Alabama, Florida, Georgia, South Carolina, and Virginia have established theirs the present year, 1872. Massachusetts, Mississippi, and Virginia have two each, which are located in different parts of the State, and are entirely distinct in their administration and government; the other States have one each. The universities of Georgia and Missouri have each established a branch in another part of the State, but these branches are under the control of the same governing board, and form a part of one industrial institution. All these industrial institutions are now opened and in operation, except those in the States of Georgia, (North Georgia Agricultural College,) Florida, Indiana, North Carolina, Ohio, and Texas. They are attended by more than 3,000 students, a large portion of whom are pursuing agricultural and mechanical studies under the care and instruction of over 350 professors. Some of these colleges in the smaller States are very much embarrassed for want of means to furnish a sufficient number of professors for conducting them profitably and successfully. A bill was introduced into the United States Senate by Senator Morrill, of Vermont, in December of the current year, which, if it should become a law, as is expected, will relieve them from the discouragements under which they are laboring. The bill proposes to give 500,000 acres of land for the further endowment of *one* national college in each State and Territory. The land is to be held in custody by the United States until it is sold, and the proceeds, after deducting expenses, are to be invested in United States bonds paying 5 per cent. semi-annually. The bonds are to be held by the treasurer of the United States, and the interest is to be disbursed for the benefit of each of the colleges in the several States and Territories. The minimum price of the Government lands is $1.25 per acre, and the interest on the proceeds of these lands, when they are all sold, will yield to each college an annual income of at least $30,000, a sum sufficient to put each college, even in the smallest State, on a firm foundation. The people are becoming deeply interested in the success of these colleges, and liberal private donations have been

made to them by both ladies and gentlemen, mention of which will be made in the notices given of the colleges in the different States. A summary of the most important facts relating to these colleges may be found in the statistical table at the close of this article.

ALABAMA.

Agricultural and Mechanical College of Alabama, at Auburn, Rev. I. T. Tichenor, D. D., president.—The land-scrip granted to this State by Congress, July 2, 1862, was sold for $216,000. The trustees of East Alabama College proposed to the legislature to give to the State their college buildings and fixtures and 200 acres of land, amounting in all to over $100,000, on condition that it would locate the Agricultural and Mechanical College at Auburn, in Lee County. The proposition was accepted, and by an act approved February 26, 1872, the college was incorporated and located at that place, and the annual revenue from the sale of the land-scrip was given for its support. It amounts to $17,000. The name of East Alabama College was changed to the Agricultural and Mechanical College of Alabama. A board of directors of the college was appointed, and on the 20th of March, 1872, they elected a faculty and adopted the courses of study and the laws and regulations for the government of the college.

The leading object of the college is to afford to students the most thorough instruction which its means will allow in the branches of learning pertaining to the industrial arts, or those which are necessary to the liberal and practical education of the industrial classes in the several pursuits and professions in life. For the accomplishment of this object four courses of study have been prepared: 1. A course for all students, occupying three years; 2. A course in agriculture; 3. A course in civil and mining engineering; 4. A course in literature and science. Each of the last three courses occupies two years. The first course is designed to furnish students a good training for the active business concerns of life, and to prepare them for entering upon the special and higher courses which follow. The time, therefore, required for students who complete any one of the higher courses will be five years. The institution was opened as an agricultural college, with the national endowment, March 25, 1872. All the students of East Alabama College who were sufficiently advanced in their studies were admitted to the Agricultural and Mechanical College. By the law of the State two students from each county are admitted to the college free of charge for tuition. They are nominated by the county superintendent, must be at least fifteen years of age; and, after completing the three years' course for all students, are required to pursue either the course in agriculture or in civil and mining engineering. The term of appointment is for one session, and is prolonged from session to session upon recommendation of the faculty until graduation.

The college-farm contains 200 acres of excellent land, embracing a great variety of soil, and admirably adapted to farm-crops, garden, and orchard. It has not been brought into a proper condition for experimental crops, but an effort is making to put it under thorough cultivation next year, and employ it for experimental purposes. Students will be required to give attention to experiments on the farm illustrative of the principles taught in the lecture-room. The college building is nearly new, and is claimed to be equal to the best in the country. The recitation-rooms are large and well constructed, and there are two society-halls, each capable of accommodating one hundred persons. The chem-

ical and philosophical apparatus are sufficient for the immediate wants of the college, and the cabinet of minerals is very comprehensive.

The number of students in attendance since the opening of the college, with the national endowment, March 25 of the present year, to the close of the session, October 30, is 103. Thirty-nine of the number are pursuing agricultural and mechanical studies.

ARKANSAS.

Arkansas Industrial University, at Fayetteville, N. P. Gates, A. M., president.—The embarrassment which existed last year in the way of obtaining the land-scrip granted to this State under act of July 2, 1862, has been removed by an act of Congress approved December 13, 1872, and the scrip will be delivered as soon as the necessary steps can be taken. The university was opened on the 22d of January of the present year, 1872, and two departments, the preparatory and normal, are already in operation. The design of the normal department is to prepare students for the business of teaching, and all who will enter into a written obligation to teach in the public schools of the State, for two years after completing the course of study of three years, are admitted free of tuition. All others are charged $10 per term. The preparatory department is under the supervision of the faculty of the university and the normal department, and has for its object the preparation of students for the normal department of the university, and for the others as soon as they shall be put into operation. The course of study in this department occupies five years. The Agricultural and Mechanical College has not yet been opened, the delay having been occasioned in consequence of not having derived any income from the national land-grant, upon which it depends for its support. As the land has now been sold, it is expected that this college will be organized and put into operation during 1873. The number of professors and assistants in the university is eight.

A farm of 160 acres was purchased in the early part of the present year, at an expense of $12,000. It is under the care of a superintendent who has made a beginning in agriculture, but little has been done on account of a want of means. The different varieties of wheat sent to the university by the Department of Agriculture were sown and the results noted. It is intended to conduct the operations of the farm on a more extended scale the next year, and with special objects in view in its culture. The funds of the university are not yet sufficiently available to warrant the commencement of the erection of the new buildings which it is contemplated to build soon. The temporary buildings, erected at an expense of $5,000, will be occupied till better ones can be supplied.

The number of students in the university during the year 1872 is 183. Of these about 40 or 50 are intending to enter upon the agricultural and mechanical course of study when that college is opened, and they have made sufficient preparation. About 30 have already given some attention to farm-work. The labor system thus far has been voluntary, and students are paid 5 to 15 cents per hour for their labor, according to their ability.

CALIFORNIA.

University of California, at Oakland, Daniel C. Gilman, A. M., president.—The most important change made in this college during the

present year is the election of Daniel C. Gilman, A. M., president of the university. President Gilman is a graduate of Yale College, and was for several years professor in the Sheffield Scientific School of that college. He has spent some time in Germany in the study of science in the University of Berlin. His inaugural address was delivered at Oakland November 7, 1872, and is replete with practical observations on the principles and character of the education which our republic demands.

Sufficient time has not yet elapsed to bring the university into so complete an organization of its different departments as is contemplated by the regents and faculty who have it in charge. A farm of about 200 acres has been provided for the agricultural department, but it has not been improved, nor are students instructed in agriculture outside of the school-room. The university has eleven professors and three assistants. The lands granted to the agricultural college by Congress July 2, 1862, have been located, and are being sold gradually in small quantities, but at present the State supports the university and college by an annual appropriation of $72,000. It is in contemplation soon to remove the university and college from their present location in Oakland to a farm or park five or six miles north of Berkeley.

CONNECTICUT.

Yale College—Sheffield Scientific School, at New Haven, Rev. Noah Porter, D. D., LL. D., president.—The prosperity of this school is increasing. In 1870 an effort was commenced to raise, by private donation, a fund of a quarter of a million of dollars for its further endowment, and, by the indomitable energy of its officers, the sum desired has been secured. With one exception, that of Mrs. Susan K. Higgin, a native of this country and widow of Robert Higgin, esq., of Liverpool, England, nearly the whole amount was contributed by persons residing in Connecticut and New York. Mrs. Higgin, when on a visit to New Haven in 1871, gave the very liberal sum of £5,000, from which the school has realized $28,000. This donation was made for the endowment of a professorship in dynamic engineering, which is called the Higgin professorship. Joseph E. Sheffield, esq., of New Haven, from whom the school takes its name, has given to it, at different times, $250,000, exclusive of a large building which he is now erecting, estimated to cost $100,000 besides the land on which it stands. This building is located on Prospect street, north of Sheffield Hall, also given to the school by Mr. Sheffield, and worth $100,000. It will be used for lecture-rooms, class-rooms, and cabinets, and will be completed in 1873.

Since the establishment of this school, in 1847, it has received from all sources, for buildings, apparatus, library, endowment of professorships, instruction fund, subscriptions to current expenses, prizes, &c., the sum of $475,000, all of which, except $135,000 granted by Congress as a national endowment fund, has been given by appreciative and liberal citizens. It is proposed to build a new chapel for the college and this school as soon as the committee, appointed for that purpose, shall be able to adopt a suitable plan. The sum of $80,000 has already been secured for this object. A friend of the school has offered to give $10,000 for the establishment of a professor's fund, on condition that $50,000 shall be raised before the commencement of 1873. Ten thousand of the remaining sum required have been subscribed, accompanied with a check for half the subscription. Hon. O. F. Winchester, of New Haven, has given, this year, thirty-two acres of land on Sachem's Ridge,

to which six acres, previously given by Mrs. James A. Hillhouse and her daughters, are added, and the entire tract will be divided into villa lots, and sold to form a fund for the foundation of an observatory for astronomical and physical researches.

In the report of the department for the last year an account was given of the fossil specimens collected for the museum by the Yale College expedition to the Rocky Mountains, in 1870. Another was made during the summer and autumn of 1871, in charge of Professor O. C. Marsh, assisted by ten graduates of the college, by which 15,000 specimens of fossil vertebrate remains have been added, including about 75 undescribed species. The specimens collected in the latter expedition are valued at $40,000, and those of the former are worth an equal sum. A valuable series of vertebrated fossils from the *tertiary* formations of Oregon has also been presented by Rev. Thomas Condon, of Dalles City, Oregon. Among the most noteworthy additions made to the museum since our last report is a collection of fossil animals from the Tertiary of Greece, received in exchange from the University of Athens. The museum has received, the present year, the largest accessions ever made in one season.

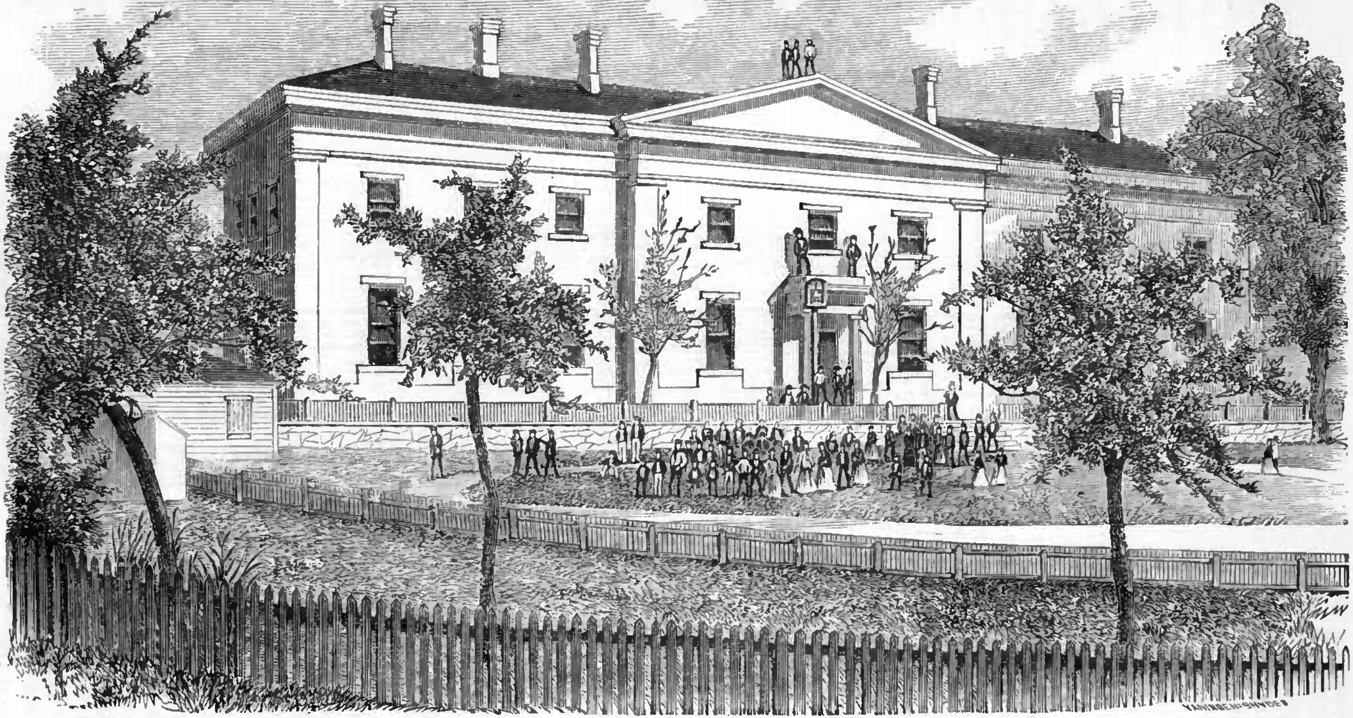
As this school has no farm, nothing has been done in practical agriculture or the raising of stock, but the most thorough scientific instruction is given, in its different branches, by learned and accomplished professors. It has 14 professors and 13 assistants; and since it was opened, in 1847, 250 students have graduated in the different courses of study, a portion of whom have engaged in agricultural pursuits. The whole number in the school during the scholastic year 1872 is 157; 29 more than in 1871.

DELAWARE.

Delaware College, at Newark, William H. Purnell, A. M., president.—There has been a considerable increase in the number of students in this college during the present year, and four instructors have been added to the faculty. The farm contains 70 acres, 18 of which are in grass, 6 in orchard, 3 in pears, 3 in apples and peaches, 1 in vineyard, 8 in blackberries, raspberries, gooseberries, and currants, and 18 in trucking and grain crops. The principal object had in view in its cultivation is to illustrate to the students the various processes pursued on the farm in the cultivation and production of crops. They make excursions to the fields, inspect the crops, and receive practical instruction from the professors of agriculture. The quantity of crops raised on the farm is not given, but their value is as follows: Garden vegetables, $1,200; corn, $150; wheat, $175; hay, $720; orchard, $300; small fruits, $300—total, $3,420.

Four horses are kept on the farm for work, twelve grade Alderney cows, two grade short-horns, and three natives, all for butter and milk. Ayrshire cows are preferred by this college for milk, Alderneys for butter, short-horns for beef, Devons for work, and for general purposes an infusion of short-horn blood with Ayrshire or Alderney. The system of farming pursued in the culture of corn is to spread barn-yard manure on the green sward after harvest, and break the ground in the spring, to spread lime in a caustic state on the inverted sod, and to follow the corn-crop with wheat and clover. Some experiments have been made in testing different varieties of seeds and fertilizers.

The number of students in attendance during the present academical year is 38, six of whom are ladies.



NORTH GEORGIA AGRICULTURAL COLLEGE.

PLATE VIII

FLORIDA.

Florida State Agricultural College.—The legislature of this State incorporated the Florida State Agricultural College February 17, 1872. By the act of incorporation, a board of directors was appointed who are authorized to receive the land-scrip to which the State is entitled under the act of Congress approved July 2, 1862, and to sell the same when they shall think most conducive to the interest of the college. Ten per cent. of the proceeds of the sales may be used for the purchase of an experimental farm, containing not less than 100 acres, and the remainder shall be invested in stocks of the United States, or of some of the States of the Union, bearing an annual interest of not less than 6 per cent. on their par value, which is to be appropriated to the maintenance of the college. They have, also, authority to locate the college, and to erect such buildings as they may think necessary for its use, and to elect the faculty and fix their salaries. Each county is entitled to send annually, or as often as vacancies may occur, one student for each member of the assembly from that county. The students are to be selected by the boards of public instruction of the several counties, from the most advanced pupils in the common and higher schools who may present themselves as candidates.

The college has not yet been located, nor has the land-scrip been received from the National Government. An effort has been made to obtain it, but in consequence of the indebtedness of the State to the Indian trust-fund, which is committed to the care of the Secretary of the Interior, it has been withheld. An act, however, has been passed by Congress, approved December 13, 1872, by which the Secretary is authorized to issue it, and it will be delivered as soon as the necessary arrangements can be made. Hon. Charles Beecher, superintendent of public instruction for that State, is president of the board of directors.

GEORGIA.

University of Georgia—Georgia State College of Agriculture and the Mechanic Arts, at Athens, Rev. A. A. Lipscomb, D. D., chancellor.—The land-scrip granted by Congress to this State under the act of July 2, 1862, was sold by the governor, January, 1872, for $243,000, agreeably to an act of the general assembly of the State approved December 12, 1866, by which he was authorized to receive and sell the land-scrip, to invest the proceeds, and to direct the establishment and organization of an industrial college, such as was contemplated by the act of Congress bestowing the national endowment. Fifty thousand dollars of this sum were paid down, and the remainder is to be paid within eighteen months from the time of the sale, or in July, 1873. The law referred to above requires that the money, as soon as paid in, shall be invested in bonds of the State of Georgia, as a perpetual fund, bearing 7 per cent. interest, which is to be appropriated to the support of the college. A change, however, has since been made in the disposition of the proceeds of the land-scrip, by which a part of the income is to be given for the support of the "North Georgia Agricultural College." The $50,000 already paid have been invested by the governor as directed, and the remainder will be as soon as it is received. The trustees of the University of Georgia, acting under the authority of the governor, established the "Georgia State College of Agriculture and the Mechanic Arts," March 30, 1872, as a department of that university, and it was organized and went into operation on the 1st day of May following.

The administrative details of the college, such as concerns its discipline and schedule of study, are intrusted to the chancellor of the university, but the special oversight of the instruction is delegated to the president of the college, under the direction of the chancellor. A number of students equal to the number of senators and representatives in the general assembly is to be appointed by the State, and educated free of charge for tuition from the income of the national endowment fund. Besides this fund the college has another, of $120,000, derived from other sources, from which it receives an annual income of $9,200. It has at present no experimental farm, but will purchase one in a few months.

For admission to the agricultural course of study students must be sixteen years of age, and well versed in geography, arithmetic, and the English language. Instruction in practical agriculture on the farm will be made a prominent feature in this course. A large quantity of excellent apparatus has been recently purchased for a working chemical laboratory, and every student in the college will be required to do actual work in chemical manipulations. Students in applied chemistry will be required to work in the laboratory, during the last year of their course, five hours daily for six days in the week.

The faculty of the college consists of William Le Roy Broun, A. M., president and professor in natural philosophy; L. H. Charbonnier, A. M., professor of engineering; Williams Rutherford, A. M., professor of mathematics; C. P. Willcox, A. M., professor of modern languages; H. C. White, B. Sc., C. E., M. E., professor of chemistry and geology; F. A. Lipscomb, A. M., professor of English and English literature; Charles Morris, A. M., professor of history; E. M. Pendleton, M. D., professor of agriculture and horticulture; Samuel Barnett, jr., A. B., instructor in mathematics; Edward Hunter, C. E., instructor in applied mathematics and mechanical drawing; L. H. Charbonnier, instructor in military tactics.

The courses of study are six, as follows:

COURSE IN AGRICULTURE.—*First year.*—Algebra; geometry; English and English literature; linear drawing; book-keeping; history. *Second year.*—Trigonometry; mensuration; surveying and leveling, with practical exercises in land and topographical surveying; geometrical drawing; descriptive geometry; rhetoric and English literature; French; elements of chemistry, including chemical physics, notation and nomenclature, theory and laws of chemical combination, the elements non-metallic and metallic, and their more important compounds and organic chemistry; laboratory practice, including chemical manipulations and blowpipe analysis; mechanics of solids, liquids, and gases; physics, including heat, light, electricity, and magnetism; meteorology; elements of astronomy; history. *Third year.*—Agricultural chemistry, including the chemical composition of the plant and the laws regulating its growth; the physical and chemical properties of the soil; the composition and use of crude and manipulated fertilizers; agriculture, its principles, its methods, and its products; the preparation of manures and composts; laboratory practice, including qualitative analysis and quantitative analysis of fertilizers; rural engineering, or mechanical and geometrical principles applied to agricultural machines, to irrigation, to road-making and draining; the law titles, contracts and accounts; mechanical and architectural drawing; botany; physiology, vegetable and animal; mineralogy and geology; French; architecture, including principles of framing and building materials; meteorology; physical geography.

2. COURSE IN CIVIL ENGINEERING.—To be admitted to this course the student must be prepared to enter upon the studies of the junior class of the university schools, and in mathematics to begin calculus. *Junior year.*—Analytical geometry; geometrical drawing; plan drawing, tinting, and lettering; chain surveying; mechanics of solids, liquids, and gases; physics, including heat, light, electricity, and magnetism; meteorology, French, railroad surveying, differential and integral calculus; topographical drawing; chemistry; descriptive geometry and application; shades and shadows; English and English literature. *Senior year.*—Stone-cutting; theory of perspective; strength of materials; industrial chemistry; laboratory practice, blowpipe analysis; analytical mechanics; astronomy, methods of determining time, latitude, and longitude; theory of stability of retaining-walls, arches, frames; bridge construction; roads; railways; canals; graphics of stone-cutting; architectural drawing; machine drawing; mineralogy; geology.

3. COURSE IN MECHANICAL ENGINEERING.—The requirements for admission to this course and also the studies of the junior year are the same as those for the junior year in the course in civil engineering. *Senior year.*—Differential and integral calculus; theory of strength of materials; theory of framing; pattern-making; molding in sand; machine-shop practice; drawings of machinery; general principles of machinery; estimation of the strength of structures of wood, stone, and iron; analytical mechanics; thermo-dynamics; machines and motors; industrial chemistry; laboratory practice; building materials; mineralogy; geology.

4. COURSE IN MINING ENGINEERING.—This course embraces all the subjects required in the course of civil engineering, and also a complete laboratory course in qualitative and quantitative analysis, with special reference to the determination of minerals, ores, metals, and alloys; assaying of ores; metallurgy and metallurgic processes; the useful minerals, modes of occurrence, prospecting, boring, blasting; methods of mining, ventilation, lighting, dressing, and concentration of ores.

5. COURSE IN BUILDING AND ARCHITECTURE.—This is a partial course in the department of engineering, and includes the studies of the junior year in the course in civil engineering, omitting a part of the higher mathematics; and, in addition, special attention to architectural drawing; structures of wood, stone, and iron; foundations, walls, arches, trusses, and roofs; the application of descriptive geometry to masonry and carpentry; strength of materials; ventilation; warming; acoustics; building materials, woods, stones, mortars, cements, and paints.

6. COURSE IN APPLIED CHEMISTRY.—*First year.*—Algebra; geometry; English and English literature; linear drawing; French. *Second year.*—General chemistry; laboratory practice, including chemical manipulations, blowpipe analysis, and qualitative analysis; mechanics of solids, liquids, and gases; physics, including light, heat, electricity, and magnetism; meteorology; elements of astronomy; English and English literature; French; German. *Third year.*—Industrial chemistry, including mining and metallurgy; metallurgic processes for the extraction of the useful metals; the manufacture of important commercial chemicals, acids, salts, and fertilizers; the manufacture of glass and porcelain; agricultural chemistry; the composition and use of crude and manipulated fertilizers; the manufacture of cane and beet sugar; of alcohol, wine, beer, and vinegar; bleaching, dyeing, calico-printing; tanning; gunpowder and other explosives; soap and candles; gas and illuminating-oils; printing; photography; laboratory practice, quantitative analysis, gravimetric and volumetric; analysis of soils, fertilizers,

blood, urine, metals, and ores; mineralogy; geology; rhetoric; French; German.

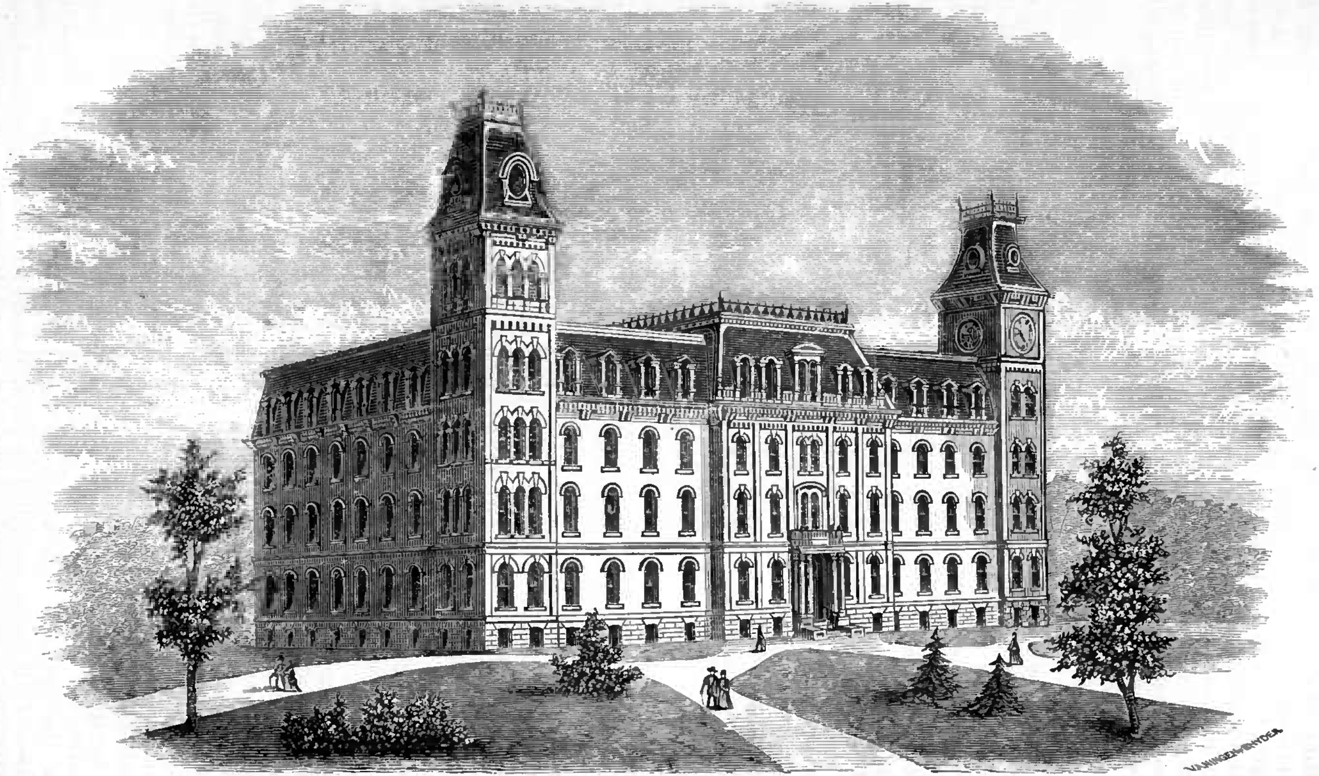
The annual college session is divided into two terms with two vacations. The first term extends from the 15th of September to the 15th of December; the second from the 15th of January to the first Wednesday in August, which is commencement-day. Tuition for all students, except State beneficiaries, $100 for the entire session. Board in college-dormitories, $12.50 per month; in private houses, $16 to $25.

North Georgia Agricultural College, at Dahlonega, Rev. A. A. Lipscomb, D. D., chancellor.—This college is pleasantly located in Lumpkin County, in the northeastern part of the State, about seventy miles from Atlanta, the capital. It was incorporated under the laws of Georgia on the 15th day of April, 1871. Congress, by an act approved the 20th of April, 1871, donated to the trustees of this college the building formerly known as the United States Branch Mint at Dahlonega, for the purposes of education exclusively, under the provisions of the act of Congress, approved July 2, 1862, for the endowment of agricultural colleges. Soon after the act of Congress donating this building and the ten acres of ground on which it is situated was passed, the Government made a deed of the property to the college. The building is a stately brick edifice in a fine state of preservation, and, with the real estate connected with it, cost the Government in 1835 over $70,000. It contains twenty-seven spacious rooms, and is sufficiently large to accommodate about four hundred students. It has lately been repaired, and was opened for the reception of students on the 1st day of January, 1873.

By an arrangement made in November, 1872, with the trustees of the University of Georgia, who received the proceeds of the land-scrip donated by Congress to this State, the North Georgia Agricultural College now forms a branch of the Georgia State College of Agriculture and the Mechanic Arts, at Athens, sixty-five miles distant. At present this institution receives but $2,000 per annum from the interest derived from the sales of the land-scrip. To this sum may be added the donation of $300 which is to be received annually from the trustees of the Peabody educational fund.

In addition to the agricultural and mechanical department there is a preparatory department, to fit students for entering upon the higher courses of study. The gentlemen selected to take charge of these departments are experienced educators. Hon. David W. Lewis, the president, is a graduate of the University of Georgia, and was for several years secretary of the State Agricultural Society. Professor Henry Perry is a graduate of Emory College, and also of a normal school, and was employed, previous to his acceptance of a position in this college, as a teacher in the city schools of Savannah, in this State. Owing to the smallness of the endowment, and the admission of students without charge for tuition, only a small entrance-fee being demanded for repairs of the college building and premises, it is proposed that a number of young gentlemen and young ladies, who have heretofore been teaching for a livelihood, and who have determined to enter the normal department, shall be employed, under the supervision of the president, to take charge of the pupils in the preparatory department. These teachers are to receive a compensation which will enable them to complete a thorough course of instruction, thus benefiting themselves and at the same time the pupils of the preparatory department. Both sexes will here receive the same educational advantages. Already about fifty girls and young ladies have procured certificates of admission, and the trustees expect at least one hundred and twenty students on the first week of the session. The

PLATE IX.



ILLINOIS INDUSTRIAL UNIVERSITY—NEW BUILDING.

two sexes will have separate rooms for study and separate grounds, but they will recite together.

Hon. William P. Price, the present member of Congress from the Dahlonega district, is president of the board of trustees, and it was largely through his influence that Congress made the generous donation of the building and grounds for the purposes of an agricultural college. It is proposed to add to the property given by the National Government a farm of about 70 acres near the college, which will make the real estate belonging to the institution worth about $2,500. Board, with good accommodations, can be obtained for $7 to $10 per month.

ILLINOIS.

Illinois Industrial University, at Urbana, John M. Gregory, LL. D., regent.—This university owns two farms—one of 213 acres, called the experimental farm, on which the university buildings stand; and the other of 410 acres, called the model farm, located about a mile from the university. Ten acres of the experimental farm are occupied by the university grounds, 15 by the arboretum, 53 by the horticultural grounds, 55 by the experimental apple-orchard, 20 by forest-plantations, and 60 are devoted to field-experiments. Of the model farm, 154 acres are cultivated with plowed crops, 14 are devoted to orchard, and 242 to mowing and pasture. The object had in view in the cultivation of the experimental farm is to afford students an opportunity for experimentation and receiving instruction in the production and improvement of agricultural and horticultural productions. Nearly all the labor performed on this farm in the field-experiments and in the different branches of the horticultural department is done by them. An effort has been made to carry out the design of illustrating the teaching given in the class-room by practical labor in the field, garden, and orchard. Some difficulty has been encountered, partly on account of the feeling on the part of the students that the time occupied in this exercise might be more profitably devoted to theoretical study, and partly from the difficulty of providing illustrative labor for a large number. Something, however, has been accomplished in this direction. The professor of botany and horticulture requires his class in horticulture to graft, set out, and take care of 1,000 apple-grafts each, annually. The facilities for furnishing illustrations in agriculture and horticulture are enlarging in consequence of the increasing care required in cultivating and pruning the experimental orchards, in the care of green-houses, in which the female students are employed to considerable extent. It is expected that in a short time plans will be so matured that all the objects contemplated in the purchase of the farm will be fully realized. The model farm is cultivated mostly by hired labor, and with the object of presenting to the students a model farm for imitation in the successful cultivation of crops for profit and for the raising and improvement of stock. They occupy only a small portion of their time in labor on this farm, and receive instruction in farm-work and the breeding and rearing of animals.

Sufficient time has not elapsed to enable the university to test fully any system of agriculture adapted to its particular locality. One fact, however, has been observed, that very shallow and often no breaking up of the ground in the spring is necessary for good crops. One plot has been cultivated with corn for four years in succession without any preparation of the ground except the use of the harrow or cultivator, and has yielded a good crop each year. This appears to result from the

peculiar soil of the locality, which is a loose, friable, and apparently rather crude vegetable mold, the deep plowing of which brings up a soil not so congenial to plant-growth on account of its chemical or perhaps mechanical condition. These are facts, however, which go to show that deep plowing here, as well as elsewhere, has been attended with profitable results; and in some experiments, now making on land that has been cultivated for twenty years without manure, it is found that in appearance the deeply plowed plots will give the heaviest crops. Common stable-manure has been applied on the model farm to the potato-crop with injurious results, in consequence of grubs breeding in the manure. When applied to corn-land in the fall previous to planting in the spring, at the rate of twenty loads to an acre, the yield has been increased ten bushels; and when applied as a top-dressing to grass-land, at the rate of thirty loads to an acre, the hay-crop has been doubled. Salt sown on wheat, at the rate of one barrel to three acres, had no apparent effect on the crop.

Experiments have been made during the present year, 1872, in comparing five varieties of broom-corn, to the extent of one acre of each, each quarter-acre being planted with a different amount of seed, so as to determine the best quantity as well as the best variety of seed; in the continuous or frequent culture of crops as compared with the ordinary culture; in the growing of root-crops, one acre each of ruta-bagas, sugar-beets from various sources, carrots, and parsnips; with corn in hills as compared with corn in drills, with the cross-experiment of planting at the distance of 3, 3½, 4, 4½, and 5 feet; with corn grown on unplowed land as compared with that grown on land plowed to a depth of 3, 5, 7, 9, and 11 inches subsoiled, and 11 inches trenched; with thirty-five varieties of flint, white, yellow, calico, and red corn; with seventy-five varieties of potatoes; with varieties of grain from the Department of Agriculture; with varieties of tomatoes and cabbages; with potatoes variously planted, as with small, large, cut, and uncut tubers; with varieties of grasses and clovers; and a commencement has been made upon the repetition of some Bavarian experiments in rotation of crops. Besides these annual field-experiments, the experimental orchard is carefully observed as to facts in relation to the leafing, blooming, and ripening of varieties, to diseases, insects, &c.; and vineyards and plantations of small fruits are being made ready with a like interest.

On the model farm, 75 acres have been planted with corn, yielding 75 bushels per acre; 60 acres were sown with oats, which were destroyed by the army-worm; 9 acres with rye, yielding 16 to 18 bushels per acre; 10 acres with spring-wheat; 100 acres meadow; and 14 acres of orchard, yielding about 1,000 bushels of apples.

There are kept on this farm a thorough-bred bull and cow or heifer of each of the following breeds: Shorthorn, Devon, Hereford, Ayrshire, and Jersey cattle, for the purpose of illustration of the lectures, and of animal husbandry, and also with the hope of making them profitable in the dissemination of improved breeds. There are also kept the Berkshire and Essex breeds of swine, and the Southdown sheep. Other breeds of all these animals, as well as of horses, will be added. To consume the crops on this farm grade-cattle are bought, and swine not of pure blood are raised.

Of the cattle kept on the model and experimental farms and raised in the State, the shorthorns are considered by breeders to be the most profitable, and far outnumber all other breeds of pure-blooded animals. They are not so much esteemed by common farmers, being too artificial,

and not adapted to rough life and short feed. The Herefords are more hardy and by some preferred. The Devons, in quality of beef and milk, are superior to the shorthorns, and endure heat and cold and rough treatment better than any other breed. The Jerseys, as butter-cows *par excellence*, are coming into favor in the suburbs of the cities and other places where the finest quality of butter will command a high price. The Ayrshires have thus far made slower advances than the other breeds. The Percheron horse, of the small or medium size, combining considerable weight with the clean limbs and action of the smaller horse, seems to be the most desirable breed for farm purposes, and is preferred by farmers to the heavier varieties which are so often imported by dealers and exhibited at fairs. The Berkshire breed of swine is preferred, although the Poland China or Magie is liked very much by many farmers. The Chester whites give good satisfaction, and are much grown. Coarse-wooled sheep have the preference at present, the Cotswold standing first.

The number of students in the university for the collegiate year 1872, is 381, of whom 328 are males and 53 females, distributed as follows: Agricultural course, 68; architecture, 4; chemical, 14; civil engineering, 45; commercial, 4; elective, 84; horticultural, 11; literature and science, 44; mechanical engineering, 33; military, 15; mining engineering, 3; natural science, 1; unassigned, 45.

INDIANA.

Purdue University—Agricultural College at La Fayette, John Purdue, president of the trustees.—This college has not yet been opened for the reception of students, nor has the board of instruction been appointed. The buildings are in course of construction, and will soon be completed. It has a farm, which has recently been increased to 184 acres, and is valued at $60,000. Nearly the whole is in grass the present year, only a small part having been cultivated. No experiments have been made as yet, but it is the design of the trustees to employ the farm for experimental purposes and instruction of the students in practical agriculture as soon as the college shall be fully organized and put in operation. The fund derived from the national land grant is constantly increasing, being invested in United States 5-20 bonds, bearing 6 per cent. interest in gold, which is paid semi-annually and added to the principal.

IOWA.

Iowa State Agricultural College, at Ames, A. S. Welch, LL. D., president.—One hundred and sixty acres of the large farm belonging to this college are cultivated with plowed crops, 20 are devoted to orchard and nursery, 15 to garden and small fruits, 125 to ornamental grounds, 250 to pasture and mowing, and 300 are covered with timber. The object in the purchase of the farm was to supply the means of instructing the students of the college in the various operations of skilled farming, of conducting such experiments as will develop facts and principles in the different branches of husbandry, and of furnishing employment for students who desire it, by which they may be able to pay a portion of their college expenses. The plan adopted for imparting instruction is for the teacher to supervise, in person, the various operations carried on by them in the field, the garden, and work-shop; and to make observations and suggestions while the work is going on. Lectures are also given in the barns and stables on the various animals

which are presented for anatomical inspection or the cure of diseases. About one-third of the work on the farm and two-thirds in the orchard and garden have been performed by them this year.

There have been raised on the farm the present season 402 bushels of Italian, White Michigan, Fife, and Lancaster Red wheat; 1,150 of Surprise barley, and Norway oats; 658 of white rye; 5,949 of yellow dent corn; 735 of yellow and red mangolds, short-leaf turnips, long orange and Belgian carrots; 952 of Early Rose and Peach-blow potatoes; and 117 tons of wild, timothy, clover, and blue-grass hay.

The system of farming adopted has been to plow wild prairie deeply in the spring and plant with corn, which, with good cultivation, often yields 60 bushels per acre. Old ground is top-dressed in the fall and winter with coarse or fine manure, and mowed two or three years; then plowed deep in the fall, planted in the spring with corn, and followed with grain; the next spring, as soon as the crop is removed, plowed and sown with rye or fall-wheat, four quarts of timothy seed being used to an acre, and the same quantity of clover in early spring. Experiments have been made with fall and spring wheat, corn, potatoes, grass, fruits, deciduous and evergreen trees, feeding swine, and in breeding nearly all domestic animals. There are kept on the farm 16 short-horn cattle, 2 Devons, 5 Ayrshires, 3 Jerseys, 42 grades, and 13 natives, making a total of 81; 15 horses of common breed; 48 swine, composed of Berkshires, Poland Chinas, and Chestervilles; and 97 sheep of the Spanish merino, Southdown, and Cotswold breeds. The whole number of animals is 241. The principal object for which these are kept is for practical experiments in testing and improving breeds and furnishing to the farmers of the State animals of superior qualities. This college prefers, for the State of Iowa, the short-horn cattle, Berkshire and Poland China swine; Spanish merino sheep for large flocks, the Cotswold for small; the Percheron stallion for crossing with large mares, and thoroughbred for roadsters.

The first class that has completed the four years' course in this college graduated this year, 1872. It contained 26 members, 17 of whom took the agricultural, 8 the mechanical, and 1 the ladies' course. The whole number of students during the collegiate year 1872 is 265, being 45 more than last year.

KANSAS.

Kansas State Agricultural College, at Manhattan, Rev. Joseph Denison, D. D., president.—No essential changes have been made in this college since our last report. The number of students has increased. Special attention is given to the operations of the farm and to horticulture. One hundred acres of the farm are cultivated with plowed crops; 95 are devoted to mowing, and 65 to orchard. The objects kept in view in the cultivation of the farm have been to afford to the students of the college facilities for practice and instruction in practical agriculture; for experiments in soils and manures, and in the methods of cultivating different crops; for acquiring skill in the use of farm-implements; for learning the different methods of improving breeds of domestic animals; and for testing the adaptability of different varieties of cultivated plants to the climate of Kansas. All these objects have been attended to during the present season, except the improvement of domestic animals, none of which are at present kept for this purpose. It is expected, however, that the funds of the college will warrant further purchases during the next year. The systems of agriculture pursued on the farm are,

rotation of crops, deep plowing, heavy manuring, thorough pulverization of the soil before planting and sowing, rolling, and in hoed crops shallow but constant cultivation for the purpose of keeping the ground clear of weeds and admitting air and moisture.

Experiments have been made in the use of stable manures, lime, plaster, and ashes; in subsoiling; effects of rolling; methods of planting oats, as by sowing broadcast, plowing in, and drilling; in seed-corn taken from the but, top, and center of the ears; in testing the adaptability of seeds received from the Department of Agriculture and other sources to the climate of Kansas; and in the effect of summer fallows on wheat sown this fall, the results of which will appear next year. There have been raised on the farm this year 2,450 bushels of corn on 35 acres, averaging 70 bushels per acre; 1,500 bushels of oats on 30 acres, averaging 50 bushels per acre; 120 bushels of rye on 6 acres, averaging 20 bushels per acre; 300 bushels of beets and mangolds; 500 bushels of potatoes; 30 tons of Hungarian hay on 13 acres; 3 tons of clover and timothy on 3 acres; 15 tons of prairie hay on 15 acres. Over 90 bushels of corn, averaging 72 pounds per bushel, were raised from one acre. Trial plots of oats produced 33 to 62 bushels per acre. Two-fifths of the work done on the farm and four-fifths in the horticultural department have been performed by the students, laboring two hours daily, under the direction of the superintendent of the farm and the department of horticulture and the foreman of the laboring corps. To further facilitate the instruction of the students, frequent botanical, geological, and entomological excursions have been made to different localities in company with the professor of the natural sciences.

The number of students in attendance during the collegiate year 1872 is 200. Since the opening of the college 13 students have graduated, nearly all of whom were farmers or the children of farmers.

KENTUCKY.

Kentucky University—Agricultural and Mechanical College, at Lexington, John B. Bowman, A. M., regent.—A change has been made during the present year in the faculty of the Agricultural and Mechanical College, by which S. M. Swingent and H. S. Williams take the places of C. Hale Tebbetts and T. V. Munson respectively. One hundred and twenty acres of the farm are devoted to plowed crops, 200 to mowing, and 5 to orchard. Nineteen-twentieths of the labor performed on the farm has been done by the students, for which they have received pay. Instruction has been given to them in the operations of the farm, and some experiments have been made, but none are sufficiently matured to be of special value to report. Forty-five tons of hemp, 20 bushels of corn, and 30 of rye have been raised on the farm the present season; also, potatoes and vegetables for market. Several cows of the Durham breed, for dairy purposes and the sale of milk, a number of horses for work, and some hogs of the Berkshire and Cheshire breeds are kept on the farm. The Durham breed of cows is preferred by this college for dairying in Kentucky. The live stock kept upon the farm is valued at $5,000, the crops at $5,000, and the farm-implements at $1,000.

The number of students in attendance at the Agricultural and Mechanical College during the collegiate year 1872 is 217.

LOUISIANA.

The situation of this State in reference to the disposition of the proceeds of the congressional land-scrip remains nearly the same as last

year. The importance of the immediate establishment of an agricultural and mechanical college was strongly urged by Governor Warmouth in his annual message, and a plan was proposed by him for carrying the measure into operation, but, from want of time for a proper consideration of the important subject, the legislature could not give it the attention which it demanded, and it failed to receive the sanction of a legal enactment.

MAINE.

Maine State College of Agriculture and the Mechanic Arts, at Orono, Rev. Charles F. Allen, D. D., president.—No changes in the faculty or course of study in this college have been made during the year, nor have any new buildings been erected. The attention of the professors has been given especially to the instruction of the students in the college and on the experimental farm. Seventeen acres are cultivated with plowed crops, eighty are in mowing, and one-half acre in orchard. The prominent objects had in view in the cultivation of the farm have been to bring it from its low condition into a high state of productiveness, to furnish labor to the students for healthy exercise and practical instruction in farming, and to afford them an opportunity of defraying a part of their expenses. All the work on the farm has been performed by the students, except what has been done by the farm-superintendent, the foreman, and two teamsters. Plats of land are assigned by the professors to the students, for experiments in the cultivation of the different crops, to which they have devoted three hours daily under the direction of the officer in charge. The experiments commenced some time ago, with cooked and uncooked food in feeding swine, and with different fertilizers on potatoes, sugar-beets, grain, and grasses, have been continued, and their results will be published in the annual report of the college.

The system of agriculture pursued in renovating grass-land is to turn the green-sward under in autumn, and in the following spring to spread and harrow in manure, and sow with grain and grass; for hoed crops, to spread and harrow in manure. The greater the quantity of manure, the greater must be the depth to which it is worked into the soil. The following crops have been raised on the farm during the present year: Potatoes, 275 bushels; Excelsior beets, 83 bushels; Lost Nation variety of wheat, 62 bushels; barley, three varieties, 164 bushels; buckwheat, two varieties; ruta-bagas, one-half acre; mangel-wurzel and sugar-beets, one-half acre; fodder-corn, one and a half acres; beans, one-fourth acre.

There are kept on the farm four horses for labor only, three native cows, four grade Durham heifers, four grade Jersey heifers, one Jersey and three grade Jersey calves. The breeds of cattle preferred by this college for the State of Maine are the Durham, the Jersey, and their grades.

Number of students for the collegiate year 1872 is 71; of graduates, 5.

MARYLAND.

Maryland Agricultural College, near Hyattsville, Rev. Samuel Regester, D. D., president.—No essential changes have taken place in this college during the present year. The objects had in view in the cultivation of the college farm are, illustration of subjects taught in the class-room, improvement of the land, profit in the sale of products, and to supply

the boarding-houses of the college with the necessary provisions. One hundred and two acres of the farm are cultivated this season with plowed crops, 28 are devoted to mowing, 10 to orchard, 12 to garden, 60 to pasture, and the remainder to timber, &c. There have been raised this year, 1,485 bushels of corn on 54 acres, 121 bushels of wheat on 12 acres, 250 bushels of oats on 24 acres; hay-crop almost a failure on account of drought. In the production of these crops, one-fourth to one-third of the labor has been performed by the students. The system of culture pursued has been to plow moderately deep, and after the sod has become decomposed, to pulverize with "subsoil cultivators," deep stirring of the soil being preferred to deep plowing. Lime and barn-yard manure have been liberally used, being applied to the surface and worked in. The domestic animals kept on the farm are four carriage-horses and seven mules for farm-work, one bull, eight Ayrshire cows, forty-four hogs for slaughter, which will average 180 pounds each; thirty-five stock-hogs, all of which are a cross of the Berkshire and Chester, and kept for the use of the college; and a large flock of poultry. The breeds of cows preferred by this college for Maryland are the Ayrshires and Devons, and of hogs, a cross between the Berkshire and Chester.

There has been an increase of students over the previous year, the number for the present collegiate year 1872 being 147.

MASSACHUSETTS.

Massachusetts Agricultural College, at Amherst, William S. Clark, Ph. D., president.—The farm of this college contains 384 acres, 43 of which are cultivated with plowed crops; 125 are in mowing, 120 in pasture, and the remainder in wood, timber, &c. The objects had in view in the purchase of the farm were to impart practical instruction to students in the different processes of agriculture, to furnish them the means of acquiring skill in the production of crops, in conducting farm-experiments, and in the use of farm-implements; also to provide for the college a botanical garden, green-house, arboretum, apple, pear, and peach orchards, a vineyard, market-garden, small-fruit garden, an experimental station, a veterinary hospital, a parade-ground, and pasture and hay for stock-raising. The most of these objects have been carried into operation, and are being perfected as rapidly as the means of the institution will permit. The students labor six hours on the farm each week, during the intervals of study, and perform the labor of planting, cultivating, and harvesting the crops; feeding, milking, and care of the stock and barns, and the training of the colts and bulls. The large bulls of the farm are broken to the yoke, and used in the place of oxen. The students have also performed considerable labor in grading, in constructing roads, culverts, and fences, and in digging up and removing useless and unsightly trees, stones, and hedges; in digging and laying drains, in setting fruit and ornamental trees, and in otherwise improving and beautifying the estate. Four teamsters are hired on the farm and employed principally with the teams. All the rest of the work not done by these is performed by the students.

There have been raised on the farm this year 480 bushels of shelled corn and 20 tons of stover on 8 acres; 500 bushels of potatoes on 4 acres —crop considerably injured by wire-worms and the rot; 48 tons of sugar-beets on 4 acres; 110 bushels of rye and 6 tons of straw on $4\frac{1}{2}$ acres; 50 bushels of barley and $2\frac{1}{2}$ tons of straw on $2\frac{1}{2}$ acres; 300 bushels of oats and 10 tons of straw on 11 acres; 2 tons of millet on one acre; 3

tons of fodder-oats on 1½ acres; 200 quarts of strawberries on 1 acre of vines, which had been badly winter-killed; 150 quarts of small fruits, from plants mostly planted the preceding year, on 2½ acres; 1,000 pounds of Concord grapes on 2 acres; 300 bushels of apples on 3 acres of old orchard; 208 tons of hay on 125 acres; and a variety of vegetables from the vegetable-garden.

In the cultivation of the farm the system of rotation of crops has been pursued, the first year usually being occupied with a crop of corn; the second, with sugar-beets, mangel-wurzels, or potatoes; the third, with oats or barley, and grass-seed. In the management of the corn-crop the following plan has been pursued the present year with satisfactory results: The manure made by the stock during the winter was hauled out in the spring and spread on the greensward at the rate of eleven cords to the acre, and plowed in six or eight inches deep, after which the land was harrowed with the Nishwitz harrow, and superphosphate spread on at the rate of 300 pounds to the acre. It was then cross-harrowed with Thomas's smoothing-harrow, and planted with corn with a two-horse dibble-machine, imported by the college from Germany last spring. This machine will plant 25 acres a day, making eight rows 18 inches apart at a passage, and dropping the corn, two or three kernels together, at intervals of 18 inches in the rows. The land was harrowed just as the corn was breaking ground, with a smoothing-harrow, and again when it was 8 inches high. When it was a foot high it was thinned to 18 inches apart in the rows, and in a few days was cultivated with the two-horse "Rüben Hack-Maschine," or root-cultivator, also imported from Germany last spring, which cultivates five rows at a passage. The land received no other cultivation, and yielded 80 bushels of sound shelled corn, 10 bushels of unsound ears, and 3 tons of stover to the acre. The total cost of raising the crop, exclusive of manure, was $18.54. The course pursued in the cultivation of the rotation-crop of the second year, the sugar-beet, is, to apply 400 pounds of commercial phosphates, and in favorable seasons a yield of 20 tons to the acre will be obtained. In the third year of the rotation the ground is sown with oats or barley, and grass-seed, without additional manure, from which a good crop of oats or barley is obtained the first year; and for the next three years three tons of hay per acre at two cuttings.

Great attention has been paid to top-dressing mowing-fields, and experience has proved the course to be satisfactory and profitable. In cases where the grass had been largely supplanted by weeds, the land has been plowed in August, harrowed with Nishwitz's or Share's harrow, and again with Thomas's smoothing-harrow. Five cords of compost, composed of three-fourths loam, were spread on an acre, and the land was then sown down with grass-seed. In place of 600 pounds of fodder, principally ox-eye daisy, (*Leucanthemum vulgare*,) to the acre, two and a half tons of first-rate hay have been obtained, and no indications of a return of the daisy have been observed. When the supply of top-dressing made on the farm has become exhausted, and the land is so completely run out as to be incapable of yielding a paying crop, it has been plowed in April, sown with oats and red clover, 10 pounds of the latter to the acre, and at the same time 300 pounds of good superphosphate were harrowed in. This course has always given a good crop of grain and straw, and also a good crop of clover the second year to cut for hay, and a second crop to turn under for manure. In this way two paying crops are obtained during the two years, the land is improved by the process, and prepared for planting the next year.

Important experiments have been conducted by the president of the

college in the cultivation of trees, grapes, and plants; in making plaster-casts, executed by the students, of different fruits and roots, for the botanical museum; also, by the professor of agriculture, in the making and use of hot-beds, the culture of garden-vegetables, and the manufacture of phosphatic manures; and by the professor of chemistry, in determining the actual and comparative cost and value of farm-yard manures and commercial fertilizers, and in the culture of the sugar-beet for seed. Under the direction of the professor of veterinary science and the farm-superintendent, the students have made experiments in deep and shallow cultivation, especially in subsoiling; in manuring with home-made and commercial fertilizers; in surface, stone, and tile draining; in cutting and curing hay at different stages of growth and by different methods; in breeding, feeding, and care of stock; in the yield of milk and growth of animals of different breeds under similar conditions, and of the same animals under varied conditions; in attending animals during parturition and in sickness; in castrating swine, calves, and lambs; in dissecting and preparing subjects for the veterinary museum; and in the effectiveness and economy of different methods of preserving roots and the leaves of the sugar-beet.

There are owned by the college and kept on the farm 6 horses of mixed breed; 15 short-horned cattle, 13 Ayrshires, 7 Jerseys, 4 Devons, 3 Britains, 1 Swiss, and 1 Dutch; 24 improved Chester white swine, 3 Berkshire, 2 Yorkshire; 60 game-fowls, 20 Houdan, 25 Partridge Cochin, 3 Sebright bantams; 20 Bronze turkeys; 4 Rouen ducks; and 31 pigeons, consisting of nine varieties, namely, Pouters, Carriers, Jacobins, Nuns, Fantails, Archangels, and Bald-pate, Beard, and Almond Tumblers. The horses are kept for work on the farm and for the college; the stock for the four-fold object of profitably consuming and converting into manure the hay, grain, and roots raised on the farm, of furnishing milk, beef, pork, poultry, and eggs for the use of the college, of keeping up and improving the races of pure-bred stock, and of affording illustrations of the principles and instruction in the practice of breeding and raising domestic animals.

Since the opening of the college in 1867, 57 students have graduated, and a large portion of them have engaged in agricultural and horticultural pursuits. Others would have done so if they had possessed the necessary capital to purchase a farm and commence the business for themselves. The number of students in attendance during the collegiate year 1872 is 171.

Massachusetts Institute of Technology, at Boston, R. D. Runkle, Ph. D., LL. D., president.—No detailed report of the operations of this institute during the present year has been received by this Department, but we learn from the catalogue sent us that there has been a very large increase in the number of students in attendance over the last year, and that the facilities for instruction have been considerably extended. Advanced courses of study have been established, by which students of the institute who have completed the regular course of four years, and taken the degree of bachelor of science, can pursue their studies two years longer, and on completing the additional course successfully will receive the degree of S. D., or doctor of science. Bachelors of arts, science, or philosophy from any other institution may enter upon any of the advanced courses on giving satisfactory evidence, by examination or otherwise, that they are qualified to pursue the course selected. Five additional scholarships of $150 each have been established, and will be given to such applicants as are recommended to one of the advanced classes of the institute by the faculty.

Excursions have been made, as during the last year, to a large number of machine-shops and manufactories in the neighboring cities for inspecting the construction of the machinery, and the various processes of manufacture performed by them. The board of instruction consists of twenty professors, two assistant professors, and twelve instructors.

The students in attendance during the present school-year are distributed as follows: Resident graduates, 5; regular students, fourth year, 35; third year, 30; second year, 59; first year, 115; students not candidates for a degree, fourth year, 19; third year, 35; second year, 30; first year, 12; in practical design, 16—total 356, an increase of 92 over the past year.

MICHIGAN.

State Agricultural College, at Lansing, T. C. Abbot, LL. D., president.—No essential changes have been made in this college during the present year. The objects contemplated in providing the experimental farm, which were to furnish to students facilities for labor, instruction, experiments in the cultivation of crops, and improvement of stock, have been kept steadily in view. Eighty-eight acres of the farm are cultivated with plowed crops, 37 are devoted to mowing, and 15 to orchard. Of the plowed land 23 acres were cultivated with wheat; 19 with oats; 32 with corn, and 14 with turnips. The students have done about four-fifths of the labor performed on the farm. Special attention has been given to the selection and rearing of improved varieties of stock. Of cattle there have been kept on the farm 17 short-horns, 13 Devons, 6 Ayrshires, 3 Galloways, 1 Jersey; of sheep, Southdown, Cotswold, Lincoln, Spanish merino, and black-faced Highland; of swine, Suffolk, Essex, and Berkshire.

Since our last report 19,358 acres of the national land-grant have been sold, making the whole number of acres now disposed of 47,232, and increasing the endowment fund to $154,178, the interest of which is applied to the support of the college.

The number of students for the collegiate year 1872 is 131, of whom 5 are resident graduates, 5 seniors, 19 juniors, 36 sophomores, 53 freshmen, 9 specials, and 4 ladies. Since the first opening of the college 68 have graduated, and a large portion of them have devoted themselves to agricultural pursuits.

MINNESOTA.

University of Minnesota—Colleges of Agriculture and the Mechanic Arts, at Minneapolis, William W. Folwell, M. A., president.—Some changes have been made in this university during the year. Eli P. Huggins, First Lieutenant United States Army, has been appointed professor in military science; M. B. Rhame, civil engineer, instructor in civil engineering and industrial mechanics; Dalston P. Stacy, instructor in agriculture and French; and H. W. Hach, instructor in English and natural sciences.

By an act of the legislature of the State approved February 29, 1872, the college of agriculture and the mechanic arts was separated into two departments, one called the College of Agriculture and the other the College of the Mechanic Arts, each having a prescribed course of study occupying four years. The College of the Mechanic Arts was opened as a distinct branch of the university September 3, 1872, and the College of Agriculture will be opened in 1873. Previous to this separation

a mixed course of study had been pursued. The instructor in agriculture was appointed in the latter part of this year. Considerable work has been done on the farm the present season by hired help, but no organized system of labor for the students has yet been adopted. Thirty acres of the farm have been cultivated with plowed crops during the year, and sixty acres are devoted to grass. No orchard has yet been planted. Three hundred bushels of corn, 496 of oats, 125 of potatoes, 8 of beets and carrots, and 80 tons of hay have been raised this season. No experiments have been conducted on the farm as yet, nor has any attention been given to the improvement of stock. Both these subjects will receive the attention of the college as soon as the different departments can be brought into complete working order.

The number of students in the university during the scholastic year 1872 is 354; of this number 117 are pursuing agricultural and mechanical studies.

MISSISSIPPI.

University of Mississippi—College of Agriculture and the Mechanic Arts, at Oxford, Rev. John N. Waddel, D. D., chancellor.—This college was opened October 2, 1872, and its object will be to teach agriculture as a profession, requiring varied knowledge and a liberal education, and not to turn out mere apprentices to the art of agriculture. The college-farm is beautifully located and well adapted to the requirements of agriculture, horticulture, and botanical experiments. It contains 110 acres, and was given to the college by the university from the lands formerly donated to the latter institution by the county of La Fayette. Twenty acres have been cultivated with plowed crops for about five years by parties unconnected with the college, and the land is now in good tilth. An additional tract of ninety acres, one-half of which is cleared, has just been inclosed with fence, and will be brought under cultivation immediately. Instruction in practical agriculture will be given to students on the farm under the direction of the professor of special and practical agriculture. They will be required to perform manual labor so far only as may be requisite for a thorough knowledge of the objects and mode of performance of agricultural operations, and to acquire familiarity with the use of farm-implements. Beyond this, farm-labor will not be imposed upon them, but they will be encouraged to engage in it, and be compensated at customary rates for any labor they may perform. They will also receive instruction in the special agriculture and geology of the State, in aid of which they will have the benefit of an extensive collection of soils, subsoils, marls, and rocks gathered during the State agricultural survey. A botanical garden, with green-house and propagating pits, under the direction and superintendence of the professor of botany, will be connected with the farm and form an important part of the general equipment of the college. Five thousand dollars have been appropriated by the trustees to make a beginning in the improvement of the farm and carrying out these objects; and it is expected that the legislature of the State will render additional assistance. Agricultural experiments will be carried on in connection with the farm and garden to such an extent as may be compatible with the requirements of instruction and the means at command. For the present the buildings, laboratory, apparatus, and library of the university will be used by the college and university in common, till provision shall be made for the former institution.

The faculty of the college consists of the chancellor, already named;

S. G. Burney, D. D., professor of English literature; C. W. Sears, M. A., of civil engineering; L. C. Garland, LL. D., of mineralogy; George Little, Ph. D., of mineralogy and geology; E. W. Hilgard, Ph. D., of agriculture and economic chemistry, and geology and agriculture of the State; J. A. Lyon, D. D., of political economy; adjunct professors—R. S. Gutherie, B. A., adjunct professor of mathematics; R. B. Fulton, B. A., of physics; R. H. Loughridge, B. S., of practical chemistry; John B. Adger, B. A., of general chemistry; M. W. Philips, M. D., of special and practical agriculture; A. B. Whitfield, B. A., instructor in history.

The agricultural course of study occupies four years, and is as follows:

FRESHMAN YEAR—*First term.*—General agriculture; botany—structural and systematic, with excursions; geometry; English—composition and rhetoric; history. *Second term.*—General agriculture; botany—determinative and economic; trigonometry, land-surveying, leveling, &c.; English—composition and rhetoric; history.

SOPHOMORE YEAR—*First term.*—Practical agriculture; special agriculture—tillage, subsoiling, drainage, &c.; zoology—general and systematic; physics; English—composition and rhetoric. *Second term.*—Practical agriculture; special agriculture—preparation of land, seeding, cultivation, harvesting, storing crops, &c.; zoology—domestic animals, animals and insects useful and injurious to agriculture; general chemistry; English.

JUNIOR YEAR—*First term.*—Practical agriculture; special agriculture—details of culture of the several crops; agriculture and economic chemistry; general chemistry; mineralogy; English—higher rhetoric. *Second term.*—Practical agriculture; agricultural and economic chemistry; special agriculture—horticulture, trench-farming, fruit-culture; geology, mineralogy; English—higher rhetoric.

SENIOR YEAR—*First term.*—Practical agriculture; stock and dairy-farming; special geology and agriculture of the State; rural-engineering, landscape-gardening, &c.; ethics; English literature; political economy. *Second term.*—Practical agriculture; stock and dairy farming; special geology and agriculture of the State; rural economy—policy of culture; general summary; ethics; political economy; English literature.

The number of students in the university during the year was 112.

Alcorn University—Agricultural and Mechanical College, at Rodney, Rev. H. R. Revels, D. D., president.—The buildings of this university were formerly the property of Oakland College, but they have been recently purchased by other parties for the purpose of establishing an institution especially devoted to the education of colored youth. Although this is its primary object, its doors are cheerfully open to all who wish to avail themselves of its advantages. The university was opened June, 1872, and has two professors besides the president. The buildings are of brick, substantially built, and in good condition, and could not now be erected for less than $100,000. The Agricultural and Mechanical College was established May 10, 1871, and is a department of the university. It is not yet organized, but the subject is now receiving the attention of the trustees, and it is expected that the organization will soon be completed, and students will enter upon a regular course of agricultural studies. There is a farm of 200 acres belonging to the university, which was purchased for $4,000, and will be used for the experimental farm of the college. The objects had in view in its purchase were illustration by practical agriculture of the principles taught in the class-room, the acquirement of facility in the use of farm-implements, skill in performing the different operations required in agriculture, and

remunerative employment for students who may desire to pay a portion of their college expenses by their own industry. It is the intention of the trustees of the college that the students shall be required to perform nearly all the labor done on the farm. A beginning has been made this year in the cultivation of the farm, and a few bushels of corn and potatoes have been raised.

The number of students in attendance at the university since it was opened is 112.

MISSOURI.

University of Missouri—Agricultural and Mechanical College, at Columbia, Daniel Read, LL. D., president.—The facilities for instruction in this college have been very much enlarged during the present year. The "Scientific Building," referred to in our last report as being in process of erection, has just been completed at an expense of $50,000. It is designed expressly for the use of this college, and contains a large working laboratory, two large cabinet-rooms, three lecture-rooms, chemical-apparatus rooms, three private studies for the professors, two agricultural-work rooms for grafting, &c., janitor's room, and wash-room, all of which are elegantly finished and furnished. Three professors have been added to the faculty, which, as now constituted, consists of the president of the university, named above; George C. Swallow, A. M., M. D., dean of the faculty; Joseph G. Norwood, M. D., professor of chemistry, physics, anatomy, and physiology; Joseph Ficklin, A. M., professor of mathematics, mechanical philosophy, and astronomy; E. L. Ripley, A. M., professor of drawing and book-keeping; Major J. Wilson McMurray, A. M., professor of military science and tactics, and farm-engineering; J. K. Hosmer, A. M., professor of rhetoric and English literature; Paul Sweitzer, A. M., professor of analytical and applied chemistry; Scott Hayes, assistant teacher in horticulture; Stephen C. Rogers, assistant teacher in agriculture; Charles V. Riley, lecturer on entomology; —— Detmers, lecturer on veterinary surgery; Thomas Maddex, farm superintendent; Hon. Norman J. Colman, Hon. James S. Rollins, and Hon. Paul Hubbard, farm committee.

The college-farm contains 600 acres, 60 of which are cultivated with plowed crops, 7 are in orchard, and 15 in meadow. It cost $60,000. The system of subsoil plowing and manuring with stable and compost manures has been adopted. The students are instructed in practical agriculture, and have performed about three-fourths of the work done on the farm during the present year. Experiments have been made in comparing the results of different varieties of corn, tomatoes, and potatoes planted early and late, and with and without manure. There have been raised on the farm the present season 500 bushels of corn, 200 bushels of oats, 200 bushels of potatoes, 10 tons of hay, 5,000 pounds of grapes, which were sold, and also many garden vegetables. The only stock kept on the farm are for work. The blooded stock, composd of short-horns and Ayrshires, have all died of the "Texas fever." The Alderney cows are preferred by this college for family use in Missouri, and Ayrshire and short-horns for the dairy. The short-horns must, however, have a rich soil, mild climate, and a level country to acquire the greatest excellence.

The college has received this year from the State $10,000 for apparatus and 5,000 for library. Only a small quantity of the land granted by Congress has been sold for cash. Some has been sold on time and some leased, and interest paid annually on the value of the land thus

disposed of. The State gave to the college last year $65,000, and from all these sources it receives an annual income of about $8,000.

The number of students in attendance in the college during the collegiate year ending in June, 1872, is 58; in the university, 322.

University of Missouri—School of Mines and Metallurgy, at Rolla, Daniel Read, LL. D., president.—This school is located in Phelps County, a district abounding in mines of iron, copper, lead, and zinc. It was opened November 23, 1871. In addition to the president the faculty consists of Charles P. Williams, A. M., director and professor of general and analytical chemistry and metallurgy; Nelson W. Allen, A. B., assistant professor of mathematics; William Cooch, assistant in analytical chemistry and assaying. There are also two other professorships, one of applied mathematics and engineering, and the other of geology and natural history, which are filled with temporary instructors. The school has two courses of study, one a preparatory course occupying one year, and the other a higher course occupying three years, as follows:

PREPARATORY COURSE.—Algebra—to quadratic equations; arithmetic—metrical system; rhetoric and composition; logic; natural history—botany, (structural and systematic;) elementary chemistry—elementary physics; physical and industrial geography—lectures.

HIGHER COURSE—*First year.*—Algebra; geometry; trigonometry; surveying and field practice; general chemistry and chemical philosophy; physics; mineralogy—descriptive and determinative; crystallography; outlines of zoology; analytical chemistry; blowpipe and humid qualitative analysis; drawing—mechanical and free-hand. *Second year.*—Trigonometry; analytical geometry; calculus; surveying—field practice; descriptive geometry—projections, shades, and shadows; machinery and motors; chemistry—general and industrial; metallurgy; physics; analytical chemistry—qualitative and quantitative humid analysis; geology—physiological, dynamical, and historical; lithology; phenomena of veins and mineral deposits; drawing—free-hand and mechanical. *Third year.*—Calculus; analytical mechanics; field practice and engineering; topography; metallurgy and assaying—wet and dry methods; analytical chemistry—quantative analysis; machinery and motors; mining—methods of exploration and exploitation; extraction; crushing and concentration; mining regions; drawing—maps, plans, and sections of mines.

For admission to the preparatory course applicants must be at least sixteen years of age, and sustain a satisfactory examination in the ordinary branches of an English education; and for admission into the higher course of three years they must be at least seventeen years of age, and pass a satisfactory examination in all the regular studies of the preparatory year.

Lectures are delivered on human physiology, domestic hygiene, and special scientific studies throughout the higher course of study. Students are also exercised in the use of instruments in land and higher surveying; visits are made to mines of iron, lead, and zinc ores, and to furnaces for the extraction of these metals; and laboratory work is performed on the products of these mines and furnaces, and work in the drawing-room on notes collected during these field operations. The school is provided with thoroughly equipped analytical and assaying laboratories, with excellent working-tables, and an abundant supply of the most approved apparatus. The physical apparatus is also of the most recent and approved forms, and very complete in the specialties of light, heat, electricity, and pneumatics. It receives annually from

the congressional land-grant $2,500, and from its own endowment, and money received from Phelps County, $9,500, making in all an annual income of $12,000.

The number of students in attendance during the present scholastic year, ending in June, 1872, is 28.

NEBRASKA.

University of Nebraska—College of Agriculture, at Lincoln, Allen R. Benton, LL. D., chancellor.—This university forms a part of the educational system of the State, and is subject to the same laws as the common schools. Its regents are appointed by the legislature, and all students who are residents of the State are admitted free of charge for tuition, and are furnished with books at cost. None of the land granted by Congress under the act of July 2, 1862, has yet been sold. Two professors, H. E. Hitchcock, A. M., professor of mathematics, and S. R. Thompson, professor of agriculture, have been added to the faculty of the university during the present year. Six courses of study have, thus far, been prepared for the university, and are now open to students, viz, the classical course, the scientific, the Latin scientific, and two courses in agriculture. The College of Agriculture was opened September 12, 1872. One of the agricultural courses occupies four years, and includes, besides studies exclusively agricultural, nearly all the English branches of an ordinary college course. The other occupies one year, and is devoted to practical agriculture only. Twenty students have commenced the full course in agriculture.

The college-farm contains 480 acres of very valuable land adjoining the city of Lincoln, and a beginning has been made in its improvement. During the summer of this year 20 acres of it, consisting of prairie land, have been broken, and will be cultivated with crops next year. The university is supplied with extensive and entirely new apparatus in the departments of chemistry and physics. The conveniences and completeness of the laboratory are said to be equal to any in the country, and ample provision is made for extensive experiments and illustration in practical and analytical chemistry. The students are furnished with a given amount of chemicals free of charge, and those of the College of Agriculture are admitted to the same privileges in the use of the apparatus, cabinets, and library as those of the other departments of the university. A spacious room has been provided for the cabinet and museum, and about 12,000 choice specimens have been collected.

The number of students in the College of Agriculture the present year is 25; in the university, 130.

NEVADA.

No information has been received from this State during the present year, but from the statements made to the Department in 1871, it is presumed that it prefers to defer the sale of its lands, and the establishment of an agricultural college till large prices can be obtained.

NEW HAMPSHIRE.

Dartmouth College—College of Agriculture and the Mechanic Arts, at Hanover, Rev. Asa D. Smith, D. D., LL. D., president.—The number of students in this college has nearly doubled during the present year.

The experimental farm now contains 163 acres, 70 of which have been brought into a tolerable state of cultivation. The system of farm-labor for the practical instruction of the students in agriculture has not yet been fully matured. A small part of the work, however, has been done by them the present year, and it is the purpose of the professors to make such arrangements as will enable them to do the greater part, and, if they choose, to pay a portion of the expense of their education. There have been raised on the farm this season, 80 bushels of corn, 200 of oats, and 70 tons of hay. Some few experiments have been made in testing the value of different kinds of commercial fertilizers.

It is the intention of the trustees to erect a new building soon, to be called the Conant Hall. It will contain rooms for the superintendent of the farm and for students, and also a boarding establishment, which will be supplied with provisions from the products of the farm, and furnish board for the students at cost. The library contains 1,200 volumes of select scientific works, about 100 of which are from the private library of the late Professor Faraday. Students also have access to the college library on the same conditions as those of the academical department.

The number of students in the College of Agriculture and the Mechanic Arts during the present academic year is 23; in all the departments, or college proper, 408.

NEW JERSEY.

Rutgers College—Scientific School at New Brunswick, Rev. William H. Campbell, D. D., LL. D., president.—The farm of the Scientific School contains 99 acres, 72 of which are cultivated with plowed crops, 25 are in grass, and the remainder is occupied by the buildings of the college and the school. In the management of the farm the prominent objects had in view are the instruction of the students in practical farming, in experimentation in crops, and in stock-raising. Students do not engage in manual labor, but are required to visit the farm and inspect the mode of cultivation of the different crops, the management of the stock, and to take special care in the conduct of the experiments. Great attention has been given to the improvement of the soil of the farm by under-draining, and manuring with green-sand marl and animal manures. Barn-yard manure is chiefly relied on for permanently enriching the soil and bringing it into a high condition of fertility. About $15,000 have been spent in the improvement and equipment of the farm since its purchase, in 1864. Elaborate and exact experiments have been made under the direction of Professor George H. Cook in the cultivation of Indian corn, with different chemical manures, the details of which are given in the eighth annual report of the Scientific School for 1872. Professor Cook has also given lectures on agriculture in the different counties of the State agreeably to law, which requires that the professor of agriculture shall deliver at least one lecture during the year in each county. During the year, 1,205 feet of tile under-drain have been laid, and all the wet land of the farm is now thoroughly drained, and can be cultivated with any farm-crop.

There have been raised on the farm the present year, 196 bushels of Mediterranean wheat on 12¾ acres, yield 15.4 bushels per acre; 20½ bushels of Fultz wheat, from seed furnished by the Department of Agriculture, on 1.15 acre, yield 18 bushels per acre; 1,668 bushelsof ears of corn on 16 acres, yield 104 bushels of ears per acre; 266 bushels of Surprise oats on 8 acres, yield 28 bushels per acre; 767 bushels of Early

Rose, Early Goodrich, Early Mohawk, and Peerless potatoes on 7 acres, yield 109 bushels per acre; 1,137 bushels of carrots on 3 acres, yield 379 bushels per acre; 1,320 bushels of mangel-wurzels on 5¾ acres, yield 229 per acre; 32 bushels of Silesian beets, from seed furnished by the Department of Agriculture, on 11 square rods, yield at the rate of 465 bushels per acre; 1,787 bushels of ruta-bagas on 4 acres, yield 446 bushels per acre; 2,000 heads of cabbages on 3½ acres. Two acres were sown with corn, and 1¼ acres with rye, both of which were cut while green, and fed for fodder to the cows on the farm. The yield was large and very profitable. There are kept on the farm 8 full-blood Ayrshire cows, 1 half-blood Ayrshire, 7 natives, 8 Ayrshire heifers, 2 horses, and 2 mules. The cows are kept for milk, which is sold in town. Fifteen of these cows averaged 2,968 quarts of milk each during the entire year. The Ayrshire breed is preferred for New Jersey by this school. The horses and mules are kept for work on the farm.

Large additions have been made to the facilities for instruction. The new geological hall, referred to in our report of last year, has been completed at an expense of some $75,000, derived from funds contributed by the alumni of Rutgers College at their recent celebration of the centennial anniversary of that institution. It was dedicated at the last commencement, in June, 1872. This donation, which amounted to $113,000, has all been devoted to the interests of the Scientific School. The sum remaining after deducting the amount paid for the geological hall, was invested in a permanent fund for the support of two professorships. The hall is made of Connecticut freestone, and is 120 feet long, 45 wide, and three stories high, besides the basement, which is used for a drill-room and armory. The first story contains an office, a large chemical-lecture room, 35 by 40 feet, an analytical laboratory for the use of students in analytical chemistry, a professor's laboratory, a small lecture-room, a balance-room, and closets for storing chemicals. The second contains a lecture-room for the professor of mining and metallurgy, and a large hall 40 by 90 feet, with gallery on four sides, for a general museum for collections in geology, paleontology, and mineralogy. The third contains a curator's room, to be used for arranging, assorting, and labeling specimens. The whole building is heated by steam, and supplied throughout with gas and water. A building for a chapel and library is now in process of erection, and is expected to be ready for occupancy at the next commencement, in 1873. It is the gift of Mrs. Sophia Astly Kirkpatrick, of New Brunswick, New Jersey, who donated $50,000 for this purpose.

The number of students in the Scientific School for the scholastic year 1872 is 50; in both institutions, 194.

NEW YORK.

Cornell University—Industrial Colleges, at Ithaca, Andrew D. White, LL. D., president.—The Agricultural College farm contains 200 acres of excellent land, 110 of which have been cultivated the present year with plowed crops, 17 are in clover, 21 in pasture, and the remainder, except what is used for ornamental grounds, is in meadow and woodland. The object had in view thus far in its cultivation has been to present to students in agriculture an example of a well-conducted farm, made profitable, if possible, and at the same time improved under the management of a good practical farmer. The system of farming heretofore adopted has been that pursued by the best practical farmers of the State, but an experimental farm of 50 acres has been set off this year from

the main farm and will be used for experimental purposes under the direction of the professor of agriculture. A regular five years' course of rotation of crops will be commenced the next season, and experiments made with such as it is thought most desirable to improve. One hundred varieties of potatoes have been raised on the farm and will be made one of the crops for experiment next year. Nearly all the work on the farm has been performed by the students, only sufficient help having been hired to insure constant labor during the season. Thirty-three acres have been cultivated this year with fall-wheat, 9 with rye, 25 with barley, 17 with oats, 18 with corn, 4 with sowed corn, 1 with roots, and 3 with garden vegetables. There have been kept on the farm 1 thoroughbred horse, 2 Clydesdale, 4 mixed breed, and several mules; 1 short-horn bull, a considerable number of short-horns in the Cornell herd, of all ages, and dairy cows and swine of mixed breeds. The Devon breed of cattle is preferred by this college for general purposes, the Durham for crossing with native stock, and Ayrshire and Jersey for dairy; also Clydesdale horses, and Cotswold, Leicester, and Southdown sheep.

In addition to the instruction given to students by the professors in the regular studies, twelve lectures have been given by Mr. H. A. Willard on dairy economy, twelve by Mr. C. V. Riley, State entomologist of Missouri, on economic entomology, and a course by Dr. Hexamer on the physiology and practical culture of the potato, by Mr. E. W. Stewart on feeding cattle, by Mr. John J. Thomas on large and Mr. Andrew Fuller on small fruits, and by Mr. James J. H. Gregory on market-gardening. The agricultural museum and library have beeen largely increased by liberal donations from various persons. The museum contains over 150 varieties of wheat, models of almost every kind of plow now in use in any part of the world, besides numerous other farm-implements of approved patterns. Mrs. Andrew D. White recently gave a large bell, weighing 5,000 pounds and costing nearly $3,000, which has been placed in the large stone tower of the McGraw building, with the nine chime-bells given by Miss Jennie McGraw. Since the opening of the university, in 1868, nearly $400,000 have been given to it by private individuals. The amount of the university fund from all sources up to the present time is $1,102,009, and the buildings are worth $560,000, making the total value of the property $1,674,009, besides the apparatus, cabinets, libraries, farm stock, &c. The regular annual income from the university fund is $80,000, and it has received this year $36,000 additional for tuition, rent, and advances from the Cornell contract.

The number of students in the College of Agriculture for the collegiate year ending in June, 1872, is 207, and in the university, 525.

NORTH CAROLINA.

University of North Carolina—Agricultural and Mechanical College, at Chapel Hill.—The organization of the Agricultural and Mechanical College, established by the act of February 11, 1867, in connection with the University of North Carolina, has not yet been effected. The exercises of the university were suspended in 1870, but information has been received that an effort is being made to resume them at an early date; and, if successful, action will probably be taken for organizing the college as soon as the funds can be made available.

OHIO.

Ohio Agricultural and Mechanical College, at Columbus.—Information has been received from Hon. Joseph Sullivant, secretary of the board of trustees, that this college has not yet been opened, but it is expected that the faculty will soon be chosen, and that students will be received for instruction at the commencement of the autumn of 1873. The experimental farm now contains 320 acres, and is valued at $112,000. A farm-superintendent has been employed during the present year, and a part of the farm has been cultivated with wheat, barley, oats, corn, potatoes, and hay. The special object had in view in its cultivation has been to improve its condition and to pay the taxes and farm-superintendent. This has been accomplished and an additional profit realized. The proceeds of the land-scrip are in the State treasury, and draw interest at 6 per cent. A library has been commenced and about 300 volumes have been collected.

OREGON.

Corvallis College—State Agricultural College of Oregon, at Corvallis, B. L. Arnold, A. M., president.—The land granted by Congress to this agricultural college has been surveyed, and an act was passed by the legislature at its last session, in September, 1872, ordering it to be sold; but it has not yet been disposed of, and consequently no aid has been derived from this source. The number of State students who are to be educated by the college without charge for tuition has been increased this year from 22, to which it was previously limited by law, to 60, and an annual appropriation of $5,000 has been made by the State for the payment of the salaries of the professors engaged in their instruction. It has received only $2,000 from other sources. The college-farm contains 36 acres, 24 of which are plowed land, 2 are devoted to orchard, and 10 to mowing. The time spent on the farm this season has been principally occupied in thoroughly plowing the land, and bringing it into good tilth. About four acres have been cultivated with garden-crops. Ten tons of hay have been raised, and corn, potatoes, peas, beans, tomatoes, squashes, turnips, and beets, in small quantities. About one-half the work on the farm has been done by the students, who receive instruction in practical agriculture in the field from the professors of the college. Nothing has been done in the improvement of the stock as yet.

The faculty of the college consists of the president, B. L. Arnold, A. M.; Joseph Emery, A. M., professor of mathematics; Hugh M. Finley, A. B.; James Liggett, professor of practical agriculture; and Mrs. Nesbit, M. S. Since the opening of the college, in 1868, six students have completed the full course in agriculture, and four of them have engaged in agricultural pursuits. A large number also have taken the partial course, in order to qualify themselves for the business of practical farming in the shortest time possible. The number of students in attendance in the agricultural college during the present year is 22; in both institutions 165, being 22 more than last year.

PENNSYLVANIA.

Agricultural College of Pennsylvania, Centre County, Rev. James Calder, D. D., LL. D., president.—The report on this college is confined principally to the "college-farm." In addition to the "college-farm" there are

three "experimental farms," each containing 100 acres, under the general supervision of the college, on which model and experimental farming is extensively conducted. Numerous experiments have been made upon these farms the present year, but the report of the board of trustees for 1872, giving the details and results, has not been received. The "college-farm" contains 300 acres, one hundred of which are occupied with the college-grounds and woodlands; 15 are in orchard, 72 in mowing, and 113 are cultivated with plowed crops. The objects had in view in the cultivation of this farm are to impart instruction to the students in the principles of agriculture taught in the school-room, to afford them exercise, and for profit in furnishing agricultual products for the use of the college. The students perform a considerable portion of the labor on this farm, being required to work two hours a day, but there is a sufficient number of hired men to carry on the work efficiently, so that no damage may occur to the crops for want of a sufficient force to finish up the work properly and in season. The general system of farming adopted has been a rotation of crops. In the detail of the cultivation of corn the practice has been to spread barn-yard manure on the soil in the fall, and turn it under, with the crop of clover growing upon it, immediately with the plow. In the case of wheat a light top-dressing of some well-decomposed manure is applied to the surface. There have been raised on the farm the present year 2,500 bushels of ears of corn, 100 of rye, 800 of oats, 800 of potatoes, 60 tons of hay, and various garden vegetables. The cattle kept on the farm are one Holstein, one Durham, and one Alderney bull, eight milk-cows, and some grade-cattle. In winter twenty head of stock are sometimes fed. The Durham breed of cattle is preferred for Pennsylvania by this college.

The progress of the college, now in the fourteenth year of its existence, is represented as steady and substantial, and the claim is preferred that it has accomplished as much as any other in the direction of carrying out the true purpose of this class of institutions, that of imparting a liberal, practical education to the working classes. While full facilities are provided for the acquisition of what we know as a liberal education, or course, the president of the college says that here "farming" is not an *ad captandum* branch in the catalogue, but a regular and productive pursuit. Chemistry is practical analysis in the laboratory, the text-book being only a basis; botany is work in the fields, and not a study of pictures only; mathematics is carried also into the field, and practical surveyors and engineers are made. In the study of botany, so important in the agricultural curriculum, at least four hours a week during the entire year are given to the analysis of plants. The botanical course extends over one year.

As recently as 1871 the trustees resolved to admit both sexes upon the same general conditions. Ladies are now, therefore, entering the classes with gentlemen without any distinction as to footing or rules of government, and on the completion of any particular course are awarded the same certificates and degrees. Several ladies are now in the higher classes.

Provision has been made for three courses of study, the agricultural, the scientific, and the classical. One of the general principles laid down is, that a knowledge of certain branches is indispensable to all: 1. The studies embraced in what is called a sound English education. 2. A knowledge of the structure and laws of health of the human body. 3. A knowledge of the Constitution and government of the country; and 4. A knowledge of the great principles of man's relation to the Deity. From the study of these no student is exempted.

The agricultural course is here given. The study of ancient and modern languages is optional. Declamation and composition exercises continue throughout the course.

HIGHER COURSE.—*First year.*—General agriculture, higher algebra, book-keeping, elementary physics, elementary botany, art of composition, analytical botany, outlines of chemistry. *Second year.*—Plant-culture, geometry, (completed,) general chemistry, economic botany, (by lectures,) soils, horticulture, trigonometry, surveying. *Third year.*—Farm-machinery, rural laws, surveying, (with field practice,) political economy, English literature, agricultural chemistry, human anatomy and physiology, blow-pipe analysis, domestic animals, fertilizers, elements of zoology, industrial drawing, physics, evidences of Christianity, Constitution of the United States and of Pennsylvania, agricultural chemistry, (lectures,) qualitative analysis. *Fourth year.*—Rural architecture, veterinary science, original essays and discussions on agricultural subjects, moral philosophy, logic, physics, (with laboratory practice,) principles of geology, civil engineering, economic zoology, landscape gardening, rural economy, mental philosophy, rhetoric, economic geology, astronomy, mineralogy, and crystallography, (lectures.)

The preparatory year embraces the studies usually prescribed by higher institutions for such a course.

The number of students in attendance during the present year is 150, being an increase of 63 over the last year.

The following table exhibits the programme of experiments adopted on the "experimental farms" of this college, made out for five years, but the system may be continued for any length of time. Every plot contains exactly one-eighth of an acre. A space of 24 inches is left between the plots to mark the divisions. The space for roads and turns around the several blocks of plots is 12 feet. The plots severally are laid off in the form of a parallelogram, 20 rods long by 1 rod wide. They are cultivated with the ordinary farm implements—plows, harrows, drills, mowers, &c. Each plot must be farmed in exact accordance with the impress made upon it in the programme. When nothing is said of the implements or of the quantity of seed to be used, the ordinary farm implements in approved use, and the usual quantities of seed, are implied. In seeds, lime, &c., the quantity expressed is that applicable to the acre, except in potatoes, when the quantity expressed applies alike to the divisions and to the relative quantities of the seed by weight or measure, and in corn when the numbers are applied to the stalks in hills three feet apart, and in rows one foot apart. The application of fertilizers, where no specification is made to test their relative quantities, is left to the superintendents of the farms respectively, under the specific and unqualified injunction that, in the application, special regard shall be had to the crops which by the programme mark diversities, and come in competition with each other. The utmost care, in such cases, must be observed in applying to all the plots thus placed in competition, the same kind, the same quality, and the same quantity of manure.

Programme of the series of experiments adopted by the board of trustees for the several farms connected with the Agricultural College of Pennsylvania.

Years of continuation of the experiments.	Common plow.	Corn, subsoil plow; wheat, Michigan plow.	Common plow.	Corn, subsoil plow; wheat, Michigan plow.	Common plow.	Corn, subsoil plow; wheat, Michigan plow.	Common plow.	Corn, subsoil plow; fallow, Michigan plow.	Common plow.	Corn, subsoil plow; wheat, Michigan plow.	Potatoes, sub-soil plow; wheat, Michigan plow.
1869	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Potatoes.
1870	Barley	Barley	Barley	Barley	Oats	Oats	Fallow	Fallow	Barley	Barley	Barley.
1871	Wheat.	Wheat.	Wheat	Wheat	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.	Wheat	Wheat.
1872	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1873	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1869	Barley	Barley	Barley	Barley	Oats	Oats	Fallow.	Fallow.	Barley	Barley	Barley.
1870	Wheat.	Wheat.	Wheat	Wheat	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.	Wheat	Wheat.
1871	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1872	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1873	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Potatoes.
1869	Wheat.	Wheat.	Wheat	Wheat	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.	Wheat	Wheat.
1870	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1871	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1872	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Potatoes.
1873	Barley	Barley	Barley	Barley	Oats	Oats	Fallow.	Fallow.	Barley	Barley	Barley.
1869	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1870	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1871	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Potatoes.
1872	Barley	Barley	Barley	Barley	Oats	Oats	Fallow.	Fallow.	Barley	Barley	Barley.
1873	Wheat.	Wheat.	Wheat	Wheat	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.	Wheat	Wheat.
1869	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.
1870	Clover	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Potatos	Potatoes.
1871	Barley	Barley	Barley	Barley	Oats	Oats	Fallow.	Fallow.	Barley	Barley	Barley.
1872	Wheat.	Wheat.	Wheat	Wheat	Wheat.	Wheat.	Wheat.	Wheat.	Wheat.	Wheat	Wheat.
1873	Clover	Clover	Timothy	Timothy	Clover	Clover	Clover	Clover	C. & T.	C. & T.	C. & T.

Programme of the series of experiments adopted by the board of trustees, &c.—Continued.

Years of continuation of the experiments.	Butt grain.	Corn, subsoil plow; wheat, Michigan plow; butt grain.	End grain.	Corn, subsoil plow; wheat, Michigan plow; end grain.	Subsoil and Michigan plow alternate years.	Lime, 50 bushels.	Corn, subsoil plow; wheat, Michigan plow; lime, 50 bushels.	Lime, 100 bushels.	Corn, subsoil plow; wheat, Michigan plow; lime, 100 bushels.	Lime, 200 bushels.	Corn, subsoil plow; wheat, Michigan plow; lime, 200 bushels.
1869	Corn	Corn	Corn	Corn	Potatoes	Corn	Corn	Corn	Corn	Corn	Corn.
1870	Barley	Barley	Barley	Barley	Potatoes	Barley	Barley	Barley	Barley	Barley	Barley.
1871	Wheat	Wheat	Wheat	Wheat	Potatoes	Wheat	Wheat	Wheat	Wheat	Wheat	C. & T.
1872	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1873	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	
1869	Barley	Barley	Barley	Barley	Potatoes	Barley	Barley	Barley	Barley	Barley	Barley.
1870	Wheat	Wheat	Wheat	Wheat	Potatoes	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1871	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1872	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1873	Corn	Corn	Corn	Corn	Potatoes	Corn	Corn	Corn	Corn	Corn	Corn.
1869	Wheat	Wheat	Wheat	Wheat	Potatoes	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1870	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1871	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C, & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1872	Corn,	Corn	Corn	Corn	Potatoes	Corn	Corn	Corn	Corn	Corn	Corn.
1873	Barley	Barley	Barley	Barley	Potatoes	Barley	Barley	Barley	Barley	Barley	Barley.
1869	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1870	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1871	Corn	Corn	Corn	Corn	Potatoes	Corn	Corn	Corn	Corn	Corn	Corn.
1872	Barley	Barley	Barley	Barley	Potatoes	Barley	Barley	Barley	Barley	Barley	Barley.
1873	Wheat	Wheat	Wheat	Wheat	Potatoes	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1869	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1870	Corn	Corn	Corn	Corn	Potatoes	Corn	Corn	Corn	Corn	Corn	Corn.
1871	Barley	Barley	Barley	Barley	Potatoes	Barley	Barley	Barley	Barley	Barley	Barley.
1872	Wheat	Wheat	Wheat	Wheat	Potatoes	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1873	C. & T.	C. & T.	C. & T.	C. & T.	Potatoes	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.

Programme of the series of experiments adopted by the board of trustees, &c.—Continued.

Years of continuation of the experiments.	Seed wheat and barley, 1 bushel; corn, 3 stalks to a hill at 3 feet; clover and timothy, 3 quarts.	Seed wheat, 2 bushels; barley, 3 bushels; corn, 1 stalk at 12 inches; clover and timothy, 2 quarts.	Lime, none.	Corn, subsoil plow; wheat, Michigan plow; lime, none.	Ter Hoven's horn-dust.	No manure.	Miller & Smith's superphosphate of lime.	Barn-yard manure.	Miller & Smith's ground bone.	Lister Brothers' ground bone.	Lister Brothers' bone-meal.
1869	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1870	Barley	Barley	Barley	Barley	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1871	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1872	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1873	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1869	Barley	Barley	Barley	Barley	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1870	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1871	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1872	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1873	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1869	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1870	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1871	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1872	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1873	Barley	Barley	Barley	Barley	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1869	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1870	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1871	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1872	Barley	Barley	Barley	Barley	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1873	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1869	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.
1870	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1871	Barley	Barley	Barley	Barley	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1872	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1873	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.

Programme of the series of experiments adopted by the board of trustees, &c.—Continued.

Years of continuation of the experiments.	Lister Brothers' bone-flour.	Harrisburgh Fertilizing Company's superphosphate of lime.	Harrisburgh Fertilizing Company's animal compost.	Harrisburgh Fertilizing Company's pure ground bone.	Breinig & Helfrich's complete bone manure.	Watson & Clark's superphosphate.	Lister Brothers' superphosphate.	Subsoil plow for corn; Michigan plow for wheat; clover plowed down.	Common plow; clover plowed down.	Subsoil plow for corn; Michigan plow for wheat; timothy plowed down.	Common plow; timothy plowed down.
1869	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1870	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1871	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1872	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1873	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1869	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1870	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1871	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1872	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1873	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1869	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1870	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1871	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1872	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1873	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1869	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1870	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1871	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1872	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1873	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1869	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.
1870	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn	Corn.
1871	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats	Oats.
1872	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat.
1873	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	C. & T.	Clover	Clover	Timothy	Timothy.

RHODE ISLAND.

Brown University—Agricultural and Scientific Department, at Providence, Rev. E. G. Robinson, D. D., LL. D., president.—A change has been made during the present year in the course of study in practical science, by which agriculture is made an important part. In addition to the other branches of the course, instruction is given in zoology and comparative anatomy, taxidermy, structural and systematic botany, on the diseases of domestic animals, the habits of useful and injurious birds and insects, in arboriculture, including pomology; in horticulture, including propagation of plants by seed, cuttings, layers, budding, grafting, and inarching; on composts and preparation of ground for different kinds of crops; on sowing, planting, and harrowing, with descriptions of various agricultural implements. The course occupies three years, and students who complete it successfully receive the degree of bachelor of philosophy. The State assembly express their entire satisfaction with the course as now improved.

Valuable additions have recently been made to the museum of natural history by the purchase of a large collection of birds belonging to the cabinet of the late John Cassin, esq., and also by the donation of the extensive collection of the late William Blanding, M. D., of Philadelphia. It contains 4,800 specimens of birds, 50 of quadrupeds, 200 of fishes and reptiles, 1,200 of insects, 8,500 of minerals, 3,500 in zoology and paleontology, 4,400 in conchology, besides numerous others of general interest.

As the agricultural department of this university has no farm, we are unable to report any experiments in practical agriculture. The number of students in the agricultural and scientific department during the present collegiate year is 27; in the university, 204.

SOUTH CAROLINA.

Claflin University—South Carolina Agricultural College and Mechanics' Institute, at Orangeburgh, Rev. A. Webster, D. D., president.—This university occupies one of the most beautiful and healthful locations in the State, and it is the design of the trustees to make it ultimately a first-class institution, equal in literary merit to any in the country. It embraces five departments, the theological, collegiate, agricultural, normal, and preparatory. The faculty consists of Rev. A. Webster, D. D., president; H. J. Fox, D. D., professor of natural sciences; E. A. Webster, professor of ancient languages; and W. H. Crogman, professor in the normal department.

The principal building of the university, formerly occupied by the Orangburgh Female College, has recently been put in thorough repair, and contains fifty rooms well adapted to college purposes. A new and substantial building, 26 by 50 feet, was completed in October of the present year, and will afford four ample recitation-rooms, which have been fitted up and furnished with improved modern school-furniture at an expense of about $5,000. In the erection of this edifice liberal aid has been received from Hon. William Claflin, of Massachusetts. An additional building has been purchased for the preparatory department, and a limited number of pupils of both sexes will be admitted, and required to pass through a regular course of study to prepare them properly for entering a higher department of the university.

On the 12th of March, 1872, the legislature of the State incorporated the South Carolina Agricultural College and Mechanics' Insti-

tute, and established it at Orangeburgh, in connection with the Claflin University, with the express condition that the college shall have no connection whatever with, nor be in any way controlled by, a sectarian denomination. Students are to be admitted into the college from each county, after a competitive examination among the scholars belonging to the public schools in such county in proportion to the number of the representation in the legislature. The college has not yet been opened, but the trustees are engaged in organizing the faculty, and the time fixed for opening is the 7th of January, 1873. No income has thus far been received from the sale of the land-scrip, but the proceeds will soon be in an available condition. The investment has been so made in bonds of the State of South Carolina that the $130,500, for which the land-scrip was sold, now constitute a fund of about $190,000, on which interest at 6 per cent. will be paid. The 1st of April of this year a college-farm was purchased by the trustees, containing 116 acres, for $9,000, and 25 acres were cultivated the present season, principally by hired labor. The crops raised were cotton, corn, rice, and sweet-potatoes. No purchases of stock have been made yet.

The collegiate year is divided into three terms, commencing about the 1st of January, April, and October, respectively. The number of students in the university for the year 1872 is 108.

TENNESSEE.

East Tennessee University—Tennessee Agricultural College, at Knoxville, Thomas W. Humes, S. T. D., president.—Considerable attention has been given by this college during the present year to the cultivation and improvement of the experimental farm, 70 acres of which have been plowed. Of this number, 40 acres have been cultivated with plowed crops, and 30 sown down with clover and other grasses for next year's crop of hay. Fifteen acres are devoted to orchard. No hay has been cut on the farm this year. There have been raised 288 bushels of wheat on 16 acres, averaging 18 bushels per acre; 480 bushels of corn on 12 acres, averaging 40 bushels per acre; and 20 acres were sown with oats, which were reduced in quantity owing to excessively dry weather in May. No system of labor has been adopted requiring students to engage in the cultivation of any of the crops raised on the farm. They are taken from the school-room into the fields where the crops are being cultivated, and are taught how and why the different operations are performed, but the work is done by hired men. The only manual labor in which the students have engaged is that of building fences and the construction of roads. The system of sub-soiling has been practiced with marked success. Some experiments in growing wheat and corn have been made during the year, the results of which will be given in the annual report of the college. No attention has thus far been given to the improvement of stock, the only animals kept on the farm being two mules, which are used for work.

Sufficient time has not elapsed for the graduation of any students in the agricultural course of study. For more than two years after the organization of the Agricultural College in June, 1869, the legislature of the State suspended its confirmation of the act of January 16, 1869, passed by the legislature of that date, and withheld from the trustees the income from the congressional endowment invested in Tennessee bonds. During the latter part of 1871 this embarrassment to the usefulness of the institution was removed, and the income has been paid in warrants on the State treasury; but owing to the financial troubles

of the State the warrants have been considerably below par. Notwithstanding these obstacles, the college is now doing a valuable work in educating the youth, who are received from every part of the State.

The number of students in attendance in the university during the collegiate year 1872 is 228, of whom 38 are in the agricultural and mechanical course.

TEXAS.

Agricultural and Mechanical College of Texas, at Bryan.—The Agricultural and Mechanical College building in process of erection, as stated in our report for 1871; but the appropriation made for this purpose is now exhausted, and nothing further can be done till additional means are provided either by the legislature or by private donations. There is some expectation that the legislature at its next session in January, 1873, will take the subject into consideration, and provide the means for completing the building and putting the college into operation at an early day. Eight hundred acres of land have been set apart for the use of the college, but no farming has been commenced. The management of the affairs of the college is placed in the hands of a board of administrators, consisting of the governor of the State, who is president, the chief justice, and eight members appointed by the governor. H. Schiller Sjoberg, of Austin, is secretary of the board. The college fund derived from the congressional land-grant has increased to $174,000. and is invested in bonds of the State of Texas, paying 7 per cent. interest in gold.

VERMONT.

University of Vermont and State Agricultural College, at Burlington, Matthew H. Buckham, A. M., president.—No material change has been made in this college during the present year. Scientific agriculture has been thoroughly taught, but we have not learned that any progress has been made in procuring a college-farm for the instruction of students in practical agriculture and for experimentation in the cultivation and improvement of different crops. The experiment of admitting young women to the academical and scientific departments of the university has thus far proved entirely satisfactory. One was admitted in 1871 and six during the present year. In confirmation of their views the executive committee of the board of trustees, in their report for 1871–'72, quote from the report of President Angell, of Michigan University, where the experiment has had a fair trial. He says, "Young women have addressed themselves to their work with great zeal, and have shown themselves quite capable of meeting the demands of severe studies as successfully as their classmates of the other sex. Their work so far does not evince less variety of aptitude, or less power of grappling even with the higher mathematics, than we find in the young men. They receive no favors and desire none." The proceeds of the congressional land-scrip are invested in Vermont State bonds, bearing 6 per cent. interest, and yield an annual income of $8,580 for the support of the agricultural college. A commencement has been made in improving the college park and adjacent grounds, and the work will be pushed as rapidly as possible.

The number of students in the college during the present year is 28, and in the university 125.

VIRGINIA.

The general assembly of Virginia passed an act approved February 7, 1872, authorizing the board of education to sell the congressional land-scrip, and invest it in bonds of the State of Virginia or of the United States, or in any other safe bonds or stocks, for the support of one or more industrial schools. In accordance with this act, the land was sold for $285,000, and $192,000 of this sum have been paid in and invested in Virginia State bonds, at 6 per cent. annually. The remainder is to be paid by the 1st of January, 1873. On the 19th of March, 1872, the general assembly established two industrial institutions, in different sections of the State, one for white students and the other for colored, as follows:

Virginia Agricultural and Mechanical College, at Blacksburgh, C. L. C. Minor, M. A., president.—In the act establishing this college, the general assembly gave two-thirds ($190,000) of the proceeds of the congressional land-grant to the Preston and Olin Institute, at Blacksburgh, in Montgomery County, on condition that the name of that institution should be changed to the "Virginia Agricultural and Mechanical College;" that the trustees should transfer, by deed, the land, buildings, and other property of the institute to the Virginia Agricultural and Mechanical College; that a certain number of students should have the privilege of attending the college without charge for tuition; and that the county of Montgomery should appropriate $20,000 to be expended in the erection of additional buildings, or in the purchase of a farm for the use of the college. These conditions were complied with by the respective parties, and the Virginia Agricultural and Mechanical College was therefore established at Blacksburgh, March 19, 1872.

A number of students, equal to the number of members in the house of delegates, is to be selected, each second year, by the school trustees, with reference to the highest proficiency and good character, from the white male pupils of the free-schools of their respective counties, cities, and election districts; or, in their discretion, from others than those attending the free-schools, and to be admitted free of tuition for two years, with the privilege of being returned by the trustees for a longer period on recommendation of the faculty of the college, for extraordinary diligence or proficiency in their studies. The course of study embraces "such branches of learning as relate to agriculture and the mechanic arts, without excluding other scientific and classical studies, and including military tactics."

The college was opened as an industrial institution, under the patronage of the National Government and the State, October 1, 1872. Besides the president, previously mentioned, the faculty consisted of General James H. Lane, A. M., graduate Virginia Military Institute, professor of chemistry and natural philosophy; Gray Carroll, M. A., professor of mathematics and modern languages; and Charles Martin, A. M., professor of the English languages and literature and of the ancient languages. The farm superintendent and professor of agriculture will be appointed in January, 1873. The college farm contains 244 acres, and cost $20,740. At present it is all in blue-grass, and intended to be used principally for raising improved stock. The college building is a substantial three-story brick edifice, 100 feet by 40, containing three recitation-rooms, a chapel, and twenty-four lodging-rooms.

The number of students in attendance during the present year, (1872,) is 113.

Hampton Normal and Agricultural Institute, at Hampton, General S.

C. Armstrong, president.—This institute is located in the county of Elizabeth City. It was first incorporated under the present name September 21, 1868, but as a State agricultural and mechanical college, with the national endowment, March 19, 1872. It received from the State one-third ($95,000) of the proceeds of the congressional land-scrip, on condition that the trustees should organize and support in the institute, from the annual interest of this fund, one or more departments, in which "the leading objects shall be instruction in such branches of learning as relate especially to agriculture and the mechanic arts and military tactics." The governor is required to appoint, on the first day of January, 1873, and on the same day in every fourth year subsequent to this, five persons, three of whom shall be of African descent, citizens of the commonwealth, to be curators of the fund set apart for the use of the institute; and without the personal presence of a majority of the curators, after a reasonable notice to all of them to be present, and without the sanction of a majority of such as are present, recorded in the minutes of the board of trustees of the institute, no action of the board taken under and by virtue of the act of March 19, 1872, is to be considered valid and lawful. The trustees of the institute are authorized to select not less than one hundred students, with reference to their character and proficiency, from the colored free-schools of the State, who shall have the privilege of attending the institute on the same terms as State students are allowed to attend the Agricultural and Mechanical College for white students.

The institute was opened for the reception of students under its present regimen, with the national endowment, June 12, 1872. The faculty consists of S. C. Armstrong, president and instructor in moral science; I. F. B. Marshall, treasurer and busines instructor; Alfred Howe, farm manager and instructor in scientific agriculture; Thomas P. Fenner, instructor in music; John H. Larry, first teacher and head of academic department, and instructor in theoretical agriculture; M. F. Armstrong, instructor in English literature; M. C. Kimber, in elocution and hygiene; Miss Mary F. Mackie, in mathematics; Miss Mary S. Hungerford, in physical science; Miss Amelia Tyler, in English grammar and composition; Miss Lucy M. Washburn, in natural science and history; Miss Mattie M. Waldron, in natural science and history; Miss Mattie M. Waldron, in natural science and grammar; Miss Helen Ludlow, in English language and history.

The principal college-building is a fine three-story hall, containing assembly and recitation rooms for three hundred students and dormitories for forty. There are also several other smaller buildings, and it is the design of the trustees to erect additional ones during the next year, (1873.)

The experimental farm contains one hundred and twenty-five acres, and cost $19,000. Twelve acres are devoted to mowing, twelve to orchard, and sixty-six are cultivated with plowed crops. All the male members of the institute receive practical instruction on the farm, and, with very few exceptions, engage in its cultivation. For this purpose a detail of a certain number of students is made daily, and they have performed about three-fourths of the labor done on the farm. There have been raised the present year 16 tons of clover-hay, 1,000 bushels of corn, 1,000 bushels of Irish potatoes, 500 bushels of sweet potatoes, 30,000 cabbages, 800 bunches of asparagus, 500 bushels of roots, 25 bushels of white beans, 200 bushels of oats, 8 tons of corn-fodder, and, also, peas, tomatoes, strawberries, &c., in moderate quantities. There are kept on the farm for milk, breeding, or labor, 2 bulls and 14

cows, of Jersey, Ayrshire, and native breeds; 1 French-Canadian stallion, 1 breeding-mare, 2 mules, and three work-horses. The Ayrshire breed of cattle is preferred by this institution. The system of deep plowing, manufacture of manures, and the rotation of crops has been adopted. Some experiments have been made in the cultivation of lucerne, and the soiling of cattle has been practiced to some extent.

The number of students of both sexes in attendance in all the departments during the present year, (1872,) is 213.

The following report of experiments made on the experimental farm of the University of Virginia, at Charlottesville, has been forwarded to this Department through the kindness of Mr. James Wearmouth, conductor of the farm. In 1868 an agricultural department was established in this University, of which Charles S. Venable, LL.D., is president, by the munificence of Samuel Miller, of Lynchburg, who gave for its support $100,000, and of Thomas Johnson, of Augusta County, who gave $40,000. It has not received anything from the national endowment. John W. Mallet, Ph. D., M. D., is professor of analytical, industrial, and agricultural chemistry, and Leopold J. Bœck, Ph. D., of mechanics and engineering, as applied to agriculture. The experimental farm contains 40 acres, on which experiments are conducted yearly with the view of improving the agriculture of Virginia, and placing it on a scientific basis. It is believed that the appended table of elaborate experiments will be read with interest and profit.

First annual report of the University of Virginia experimental farm, 1872.

	Plot.	Part of an acre.	Section.	Part of an acre.	Crop.	When plowed.	Upland or lowland.	Wet or dry.	Drained or undrained.	Kind of soil.	Date of sowing.	By hand or machine.	Quantity of seed per acre.	Quantity of fertilizers used.	Value of fertilizers.	
1	1	½	1	1-16	Black-eyed pea	Mar. 25	Upland	Dry	Undrained.	Green sandy loam.	Apr. 29	By hand.	2 bus.	25 lbs. superphosphate, 10 lbs. potash.	$1 18	1
2	...	...	2	⅜	Common corn	Mar. 19	...do	..do	...do	...do	Apr. 17	...do	1 peck.	No manure		2
3	2	½	1	⅛	...do	Mar. 19	...do	..do	...do	...do	Apr. 17	...do	1 peck.	50 lbs. superphosphate, 18 lbs. potash.	2 17	3
4	...	...	2	⅛	...do	Mar. 19	...do	..do	...do	...do	Apr. 17	...do	1 peck.	¾ of a load of horse-manure.	1 50	4
5	...	...	3	⅛	...do	Mar. 19	...do	..do	...do	...do	Apr. 17	...do	1 peck.	No manure		5
6	...	...	4	⅛	White Schonen oats	Mar. 25	...do	..do	...do	...do	Apr. 27	...do	1¾ bus.	50 lbs. superphosphate	1 37	6
7	3	½	0	⅛	Brunswick oats	Mar. 22	...do	..do	...do	...do	Mar. 29	...do	2 bus.	200 lbs. superphosphate	5 50	7
8	...	...	2	⅛	Perennial rye-grass*	Mar. 22	...do	..do	...do	...do	Mar. 30	...do	1 bus.			8
9	...	...	4	⅛	Italian rye-grass*	Mar. 22	...do	..do	...do	...do	Mar. 30	...do	1 bus.			9
10	4	[illegible]	..	½	Brunswick oats	Mar. 22	...do	..do	...do	...do	Mar. 29	...do	2 bus.	200 lbs. superphosphate	5 50	10
11	...	...	...	½	Lucerne	Mar. 22	...do	..do	...do	...do	Mar. 30	...do	12 lbs.			11
12	5	½	...	½	White sugar-beets	Apr. 4	...do	..do	...do	Red loam	Apr. 23	...do	6 lbs.	200 lbs. superphosphate, 37 lbs. potash.	7 35	12
13	7	½	1	¼	Orange mangel-wurzel	Apr. 3	...do	..do	...do	...do	Apr. 24	...do	7 lbs.	100 lbs. superphosphate, 37 lbs. potash.	4 23	13
14	...	...	2	¼	Mangel-wurzel beet	Apr. 3	...do	..do	...do	...do	Apr. 23	...do	7 lbs.	...do	4 23	14
15	8	½	1	⅛	Carter's Red Globe mangel.	Apr. 3	...do	..do	...do	...do	Apr. 25	...do	6 lbs.	50 lbs. superphosphate, 18 lbs. potash.	2 11	15
16	...	...	2	⅛	Carter's nursery sugar-beet.	Apr. 3	...do	..do	...do	...do	Apr. 25	...do	7 lbs.	...do	2 11	16
17	...	...	3	1-16	Vilmorin's sugar-beet	Apr. 3	...do	..do	...do	...do	Apr. 27	...do	7 lbs.	25 lbs. superphosphate, 9 lbs. potash.	1 06	17
18	...	...	4	1-16	White Silesian sugar-b't.	Apr. 3	...do	..do	...do	...do	Apr. 27	...do	7 lbs.	...do	1 06	18
19	...	...	5	1-16	Red Giant mangel-wurzel	Apr. 3	...do	..do	...do	...do	Apr. 26	...do	7 lbs.	...do	1 06	19
20	...	...	6	1-16	Long-red mangel-wurzel.	Apr. 3	...do	..do	...do	...do	Apr. 25	...do	4 lbs.	...do	1 06	20
21	1	¼	...	¼	Ruffled oats	Mar. 30	...do	..do	...do	Clay loam	Apr. 3	...do	2 bus.	100 lbs. superphosphate	2 75	21
22	...	...	...	.....	Lucerne	Mar. 30	...do	..do	...do	...do	Apr. 3	...do	10 lbs.			22
23	0	...	...	½	Fultz wheat	Oct., 1871	...do	..do	...do	Sandy loam	Oct. 5, '71	Machine.	1½ bus.	Top-dressed with 150 lbs. nitrate of soda and 150 lbs. sulphate of ammonia.	12 00	23
24	8	¼	1	3-16	Cooley's early corn	Mar. 30	...do	..do	...do	Clay loam	Apr. 25	By hand.	1 peck.	75 lbs. superphosphate, 27 lbs. potash.	3 13	24
25	...	¼	2	1-16	Flax	Mar. 30	...do	..do	...do	...do	Apr. 6	...do	½ bus.	50 lbs. superphosphate	1 37	25
26	0	...	...	¼	Strap-leaved turnips	July 19	...do	Wet.	...do	Sandy loam	July 22	...do	2 lbs.	100 lbs. superphosphate, 37 lbs. potash.	4 23	26

27	...	...	...	1-16	Ruta-baga	July 17	Upland	Dry	Drained	Sandy loam	July 17	By hand	2 lbs	18 lbs. superphosphate, 9 lbs. potash.	87	27
28	0	1	...	1	Corn	June —	Lowland	Wet	Undrained & drained.	do	June 8	do	1 peck	No manure	....	28
29	...	...	...	.....	Jute	Mar. —	Upland	Dry	Undrained.	Gray loam	Apr. 6	....	....	....	....	29
30.	...	...	...	.....	Licorice†	Mar. —	do	do	do	do	Apr. 6	....	....	....	....	30

* The season was too dry for the rye-grasses and the lucerne.

† Licorice never made its appearance.

First annual report of the University of Virginia experimental farm, 1872—Continued.

	Quantity of fertilizers used per acre.	Value of fertilizer per acre.	Time of harvesting.	Quantity of grain.	Quantity of grain per acre.	Weight per measured bushel.	Quantity of straw.	Quantity of straw per acre.	Quantity of chaff.	Quantity of chaff per acre.	Quantity of roots.	Quantity of roots per acre.	Value of crop.	Value of crop per acre.	Working expenses inclusive of manures.	Working expenses per acre inclusive of manures.	Loss.	Loss per acre.	Profit.	Profit per acre.	
					Bus.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*									
1	400 lbs. superphosphate, 150 lbs. potash.	$18 40	June 11	7 pints	1¾	64	15	240					$0 45	$5 60	$2 39	$38 24	$1 94	$32 64			1
2	No manure		Sept. 16	2½ bus.	4¾	52	378	1,016					3 50	6 35	5 76	15 36	2 26	9 01			2
3	400 lbs. superphosphate, 150 lbs. potash.	18 40	Sept. 14	3¼ pecks.	7	52	110	880					1 16	8 30	3 94	31 50	2 78	23 10			3
4	6 loads horse manure	12 00	Sept. 14	2 bus.	16	52	138	1,108					2 20	17 60	3 20	25 60	1 00	8 00			4
5	No manure		Sept. 14	1⅛ bus.	9	52	116	928					1 40	11 20	1 30	10 40			$0 10	$0 80	5
6	400 lbs. superphosphate	11 00	June 26	1½ pecks.	6	31	22	176	11	88			41	3 28	1 35	10 80	94	7 52			6
7	do	11 00	July 2	3¾ pecks.	7⅛	31	92	184	29	58			1 51	3 02	5 32	10 64	3 81	7 58			7
8																					8
9																					9
10	400 lbs. superphosphate	11 00	July 2	3¼ bus.	6½	31	102	204	26	52			2 77	5 54	9 20	18 40	6 43	12 86			10
11																					11
12	400 lbs. superphosphate, 77 lbs. potash.	14 70	Nov. 13			56					4,255	8,510	34 05	68 10	27 95	55 90			6 10	12 20	12
13	do	16 92	Nov. 23			56					760	3,040	6 10	24 40	12 93	51 72	6 83	27 32			13
14	do	16 92	Nov. 23			56					855	3,420	6 85	27 40	12 93	51 72	6 08	24 32			14
15	do	16 92	Nov. 23			56					555	4,440	4 45	35 60	6 64	53 12	2 19	18 52			15
16	do	16 92	Nov. 23			56					200	1,600	1 60	12 80	6 64	53 12	5 04	40 32			16
17	do	16 92	Nov. 25			56					499	7,980	4 00	64 00	4 10	65 60	10	1 60			17
18	do	16 92	Nov. 25			56					635	10,160	5 10	81 60	4 10	65 60			1 00	16 00	18
19	do	16 92	Nov. 23								465	7,440	3 70	59 20	4 10	65 60	40	6 40			19
20	do	16 92	Nov. 23								565	9,050	4 55	72 80	4 10	65 60			45	7 20	20
21	400 lbs. superphosphate	11 00	July 2	4¾ pecks.	4¾	26	55	220	12	48			1 27	5 08	3 65	14 60	2 38	9 52			21
22																					22
23	Top-dressed with nitrate of soda and sulphate of ammonia, 300 lbs. per acre each.	24 00	July 15	3 bus.	6	60	215	430	76	152			9 75	19 50	14 00	28 00	5 25	9 00			23
24	400 lbs. superphosphate, 150 lbs. potash.	16 92	Sept. 17	2⅛ bus.	8½	56	332	1,328					1 92	10 24	6 00	32 00	4 08	21 76			24
25	400 lbs. superphosphate	11 00	June 26	1½ pecks.	6	56	40	640					60	9 60	2 00	32 00	1 40	22 40			25
26	400 lbs. superphosphate, 150 lbs. potash.	16 92	Nov. 20			55					4,248	16,992	34 10	136 40	12 62	50 48			21 38	85 92	26
27	300 lbs. superphosphate, 100 lbs. potash.	12 25	Nov. 20			60					946	15,136	6 70	107 20	3 00	48 00			3 70	59 20	27

28	No manure		Sept. 15	50 bus	50	56							45 00	4500	8 00	8 00			37 00	37 00	28
29																					29
30																					30
																	52 91	281 97	67 73	218 32	

AS. WEARMOUTH, *Conductor of Experiments.*

WEST VIRGINIA.

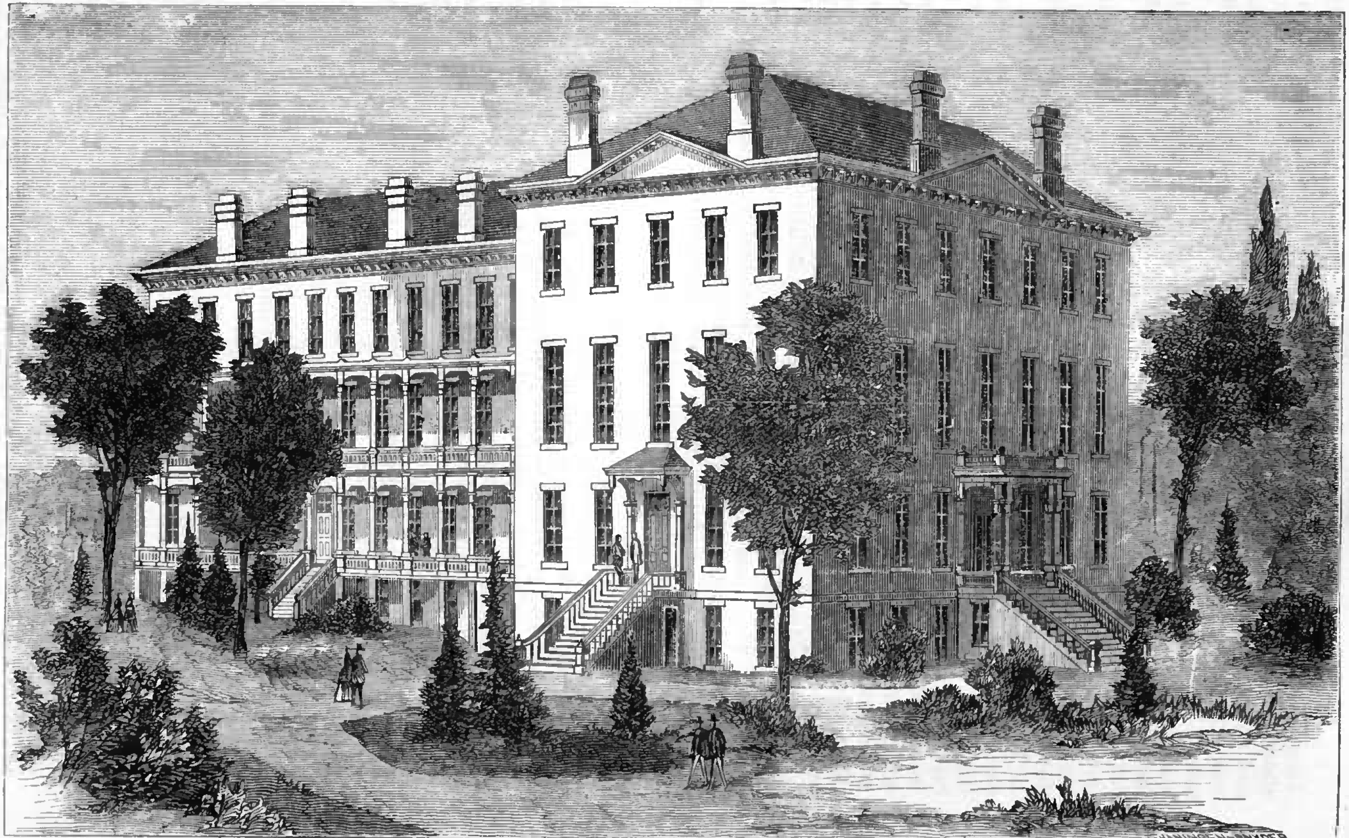
West Virginia University—Agricultural department at Morgantown, Rev. Alexander Martin, D. D., president.—The experimental farm contains about 25 acres, a part of which is occupied by the university buildings and campus, 5 acres are cultivated with plowed crop, 3 are in orchard, 5 in grass, and the remainder in pasture. Owing to various embarrassments little has been done thus far in agriculture. The trustees are making an effort to purchase more land, and to furnish students better facilities for the study of practical farming in the field. The labor system adopted for the students is voluntary, but it is the desire of the faculty to make a more efficient organization as soon as possible, and to carry out more fully the objects contemplated by Congress in the endowment of agricultural colleges. A professor of agriculture, William M. Fontain, A. M., has just been elected, and has entered upon his duties. The university has two good buildings, which are occupied, and a third in process of erection. Besides the income from the national land grant it now receives annually $16,000 from the State, and is free from debt. The legislature has also appropriated $2,500 for the erection of an armory to be constructed according to a plan furnished by the War Department. It has received from the Patent-Office 1,000 models for illustration in agriculture and the mechanic arts, and in mining engineering, &c.; and from the War Department 5,000 dollars' worth of ordnance and ordnance stores for the use of the military department. The arms and equipments are all of the most improved and modern construction. The museum has also been enriched by donations from the Smithsonian Institution and other parties.

The number of students in the labor corps during the present collegiate year is 22. In the university, 159.

WISCONSIN.

University of Wisconsin—College of Arts, at Madison, Rev. J. H. Twombly, D. D., president.—This college has a farm of 234 acres, a large portion of which is under cultivation. As we have not received the annual report of the university for 1872 we are unable to give any details of the farming and experiments which have been conducted on it during the present year. Facilities for instruction are constantly enlarging, and the number of students is increasing. The number in the college of arts, which includes the agricultural and mechanical studies, has nearly doubled since last year. A department of mining and metallurgy has recently been established in the university, and is now fully organized and ready for work. The design in this department is to furnish instruction in the various operations necessary for the intelligent and successful working of mines and ores. Laboratories are provided and completely equipped for practical instruction in analytical chemistry, and assaying and determinative metallurgy. In some particulars, and especially in the large assaying laboratory just fitted up, this department of the university is said to have advantages not possessed by any other western institution.

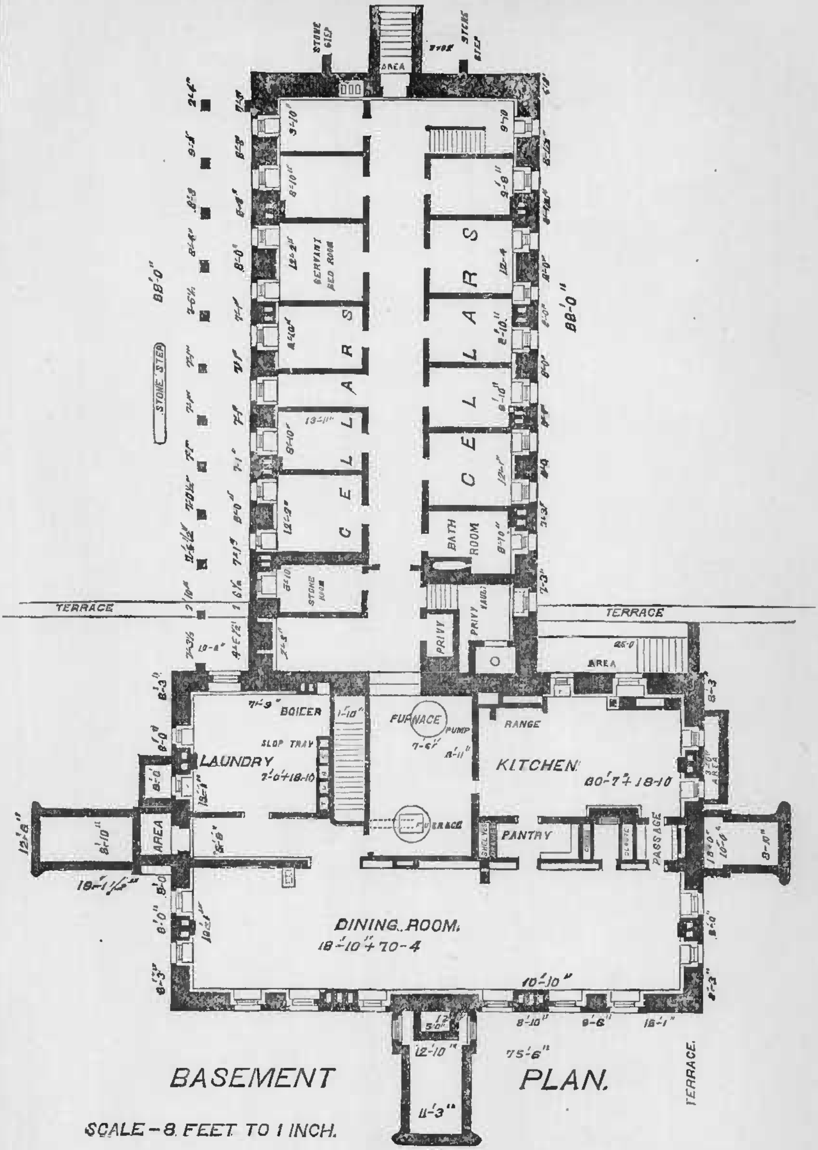
The female college forms an important feature in this university. The course of study is similar to that in the college of arts, and is designed to be fully equivalent to it. Ladies are also allowed to enter the other colleges and departments of the university, and the same degrees are conferred upon them as upon gentlemen for the satisfactory completion of any course of study. A pretty full account of this college was



FEMALE COLLEGE OF WISCONSIN.

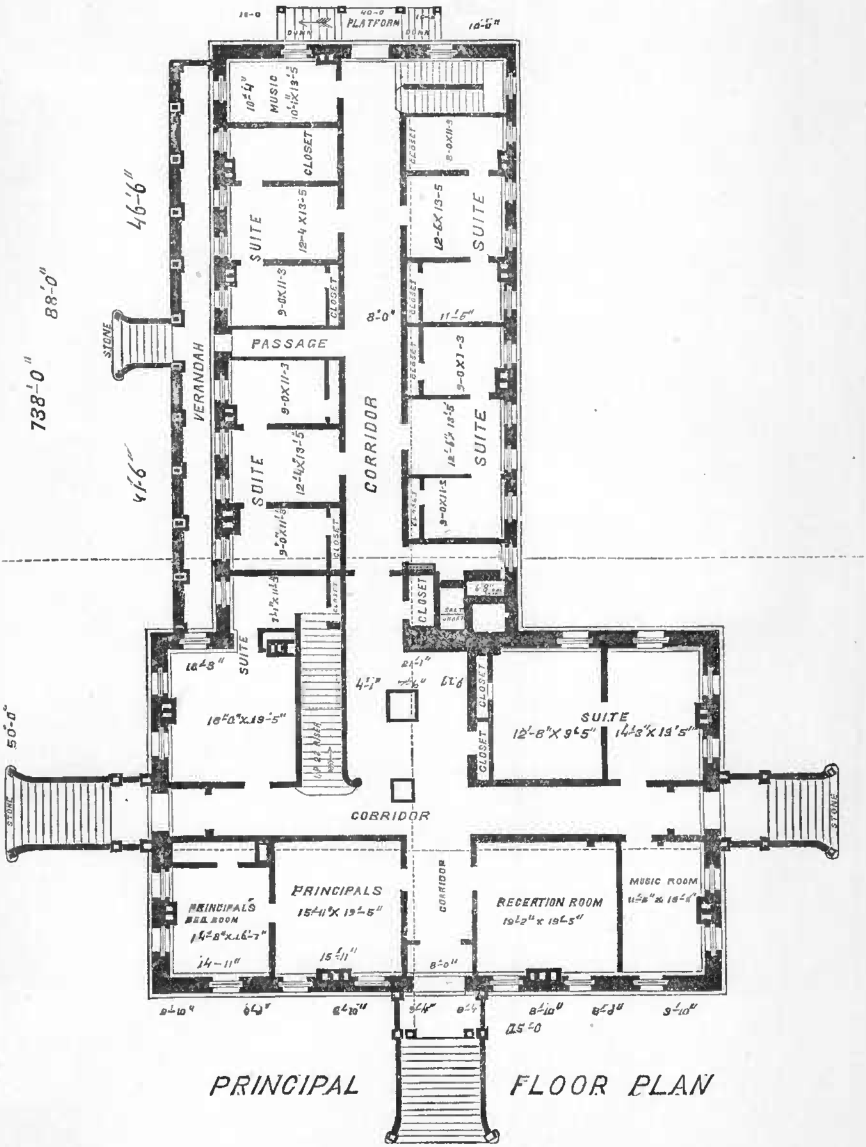
PLATE X.

PLATE XI.



FEMALE COLLEGE OF WISCONSIN.

PLATE XII.



FEMALE COLLEGE OF WISCONSIN.

given in the report of the Department for the last year, (1871,) and we now present a cut of the college building, which may be seen on the opposite page.

The university has a library of its own, numbering 4,600 volumes, and the students also have access, free of charge, to the library of the State Historical Society, which contains 50,000 volumes, embracing almost every subject concerning which information might be desired. The number of students in the university of the present collegiate year is 517, 93 of whom are in the college of arts, and 139 in the female college.

Statistics for 1872 of the industrial institutions of the United States which have

Number of States having industrial institutions.	Location of the institution. State.	Location of the institution. Town.	Number of industrial institutions.	Name of the institution.
1	Alabama	Auburn	1	Agricultural and Mechanical College of Alabama
2	Arkansas	Fayetteville	2	Arkansas Industrial University
3	California	Oakland	3	University of California—Agricultural, Mining, and Mechanic Arts College.
4	Connecticut	New Haven	4	Yale College—Sheffield Scientific School
5	Delaware	Newark	5	Delaware College
6	Florida		6	Florida State Agricultural College*
7	Georgia	Athens; Dahlonega	7	University of Georgia {Georgia State College of Agriculture and the Mechanic Arts; North Georgia Agricultural College.*}
8	Illinois	Urbana	8	Illinois Industrial University
9	Indiana	La Fayette	9	Purdue University—Agricultural College*
10	Iowa	Ames	10	Iowa State Agricultural College
11	Kansas	Manhattan	11	Kansas State Agricultural College
12	Kentucky	Lexington	12	Kentucky University—Agricultural and Mechanical College.
	Louisiana		....	(1. No industrial institution established in the State)
13	Maine	Orono	13	Maine State College of Agriculture and the Mechanic Arts.
14	Maryland	NearHyattsville.	14	Maryland Agricultural College
15	Massachusetts	Boston	15	Massachusetts Institute of Technology
		Amherst	16	Massachusetts Agricultural College
16	Michigan	Lansing	17	Michigan State Agricultural College
17	Minnesota	Minneapolis	18	University of Minnesota {College of Agriculture; College of the Mechanic Arts}
18	Mississippi	Oxford	19	University of Mississippi—College of Agriculture and the Mechanic Arts
		Rodney	20	Alcorn University
19	Missouri	Columbia; Rolla	21	University of Missouri {Agricultural and Mechanical College. School of Mines and Metallurgy.}
20	Nebraska	Lincoln	22	University of Nebraska—College of Agriculture
	Nevada		...	(1. No industrial institution established in the State)
21	New Hampshire.	Hanover	23	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts.
22	New Jersey	New Brunswick.	24	Rutgers College—Scientific School
23	New York	Ithaca	25	Cornell University—Industrial Colleges
24	North Carolina	Chapel Hill	26	University of North Carolina—Agricultural and Mechanical College.*
25	Ohio	Columbus	27	Ohio Agricultural and Mechanical College*
26	Oregon	Corvallis	28	Corvallis College—State Agricultural College of Oregon.
27	Pennsylvania	Centre County	29	Agricultural College of Pennsylvania
28	Rhode Island	Providence	30	Brown University—Agricultural and Scientific Department.
29	South Carolina	Orangeburgh	31	Claflin University—South Carolina Agricultural College and Mechanics' Institute.
30	Tennessee	Knoxville	32	East Tennessee University—Tennessee Agricultural College.
31	Texas	Bryan	33	Agricultural and Mechanical College of Texas*
32	Vermont	Burlington	34	University of Vermont and State Agricultural College.
33	Virginia	Blacksburgh	35	Virginia Agricultural and Mechanical College
		Hampton	36	Hampton Normal and Agricultural Institute
34	West Virginia	Morgantown	37	West Virginia University—Agricultural Department
35	Wisconsin	Madison	38	University of Wisconsin—College of Arts

* The college is not opened.

received the national endowment of land-scrip under the act of July 2, 1862.

Securities in which the fund derived from the United States land-scrip is invested.	Value of the agricultural and mechanical college buildings.	Value of the philosophical and chemical apparatus of the agricultural and mechanical college.	Value of the agricultural and mechanical college farm.
In Alabama State bonds, at 8 per cent., paid semi-annually	$100,000	$2,000	$2,000
The land-scrip has not yet been delivered to this State	5,000	...	12,000
Only a very small quantity of the land has been sold	...	...	...
In Connecticut State bonds, at 6 per cent., paid semi-annually	225,000	25,000	No farm.
In Delaware State bonds, at 6 per cent	50,000	6,000	15,000
The land-scrip has not yet been delivered to this State	...	...	No farm.
In Georgia State bonds, at 7 per cent	130,000*	10,000	No farm.
	70,000	...	2,500
In Illinois State and county bonds	200,000	15,000	60,000
In United States 5-20 bonds, at 6 per cent. in gold	25,000	...	60,000
In Iowa State bonds; only a small part of the land sold	237,000	7,000	10,584
In school-district bonds and real estate; only a part of the land sold	31,000	...	3,000
In Kentucky State bonds, at 6 per cent	120,000*	15,000†	130,000
In Louisiana State bonds, at 6 per cent., paid semi-annually	...	...	...
In Maine State bonds, at 6 per cent., paid semi-annually	65,000	4,000	...
In Southern relief bonds, by the authority of the State of Maryland	60,000	1,200	13,500
In farm and in United States bonds, (and others,) at 6 per cent. in gold	...	...	...
	163,500	7,000	37,500
In care of the State, which pays 7 per cent	109,500	4,000	10,148
In farm, and in Missouri State bonds, and secured on lands sold	1,200	...	8,500
	...	...	...
In Mississippi State bonds, at 8 per cent	...	...	1,100
	100,000	...	4,000
Only a small quantity of the land has been sold for cash, interest paid on its valuation.	75,000	10,000	60,000
	...	9,000	...
None of the land has been sold	...	3,800	...
...	...	...	...
In New Hampshire State bonds, at 6 per cent	50,000	1,000	15,000
In New Jersey State bonds, at 6 per cent	75,000	...	30,000
In New York State stocks and other securities	560,000*	12,000	40,000
In North Carolina State bonds	...	...	No farm.
In the State treasury, on interest at 6 per cent., paid semi-annually	...	...	112,000
None of the land has been sold	6,000	1,000	5,000
In farm, and in Pennsylvania State bonds, at 6 per cent	300,000	4,000	59,136
In Rhode Island State bonds, at 6 per cent	...	...	No farm.
In South Carolina State bonds, at 6 per cent	35,000*	...	9,000
In Tennessee State bonds, at 6 per cent	53,000*	1,000	30,000
In Texas frontier-defense bonds, at 7 per cent in gold	...	...	...
In Vermont State bonds, at 6 per cent	...	...	No farm.
In Virginia State bonds, at 6 per cent	14,000	...	20,740
	75,000	400	19,000
In United States bonds, at 6 per cent	80,000*	4,000†	...
In Wisconsin State bonds, at 7 per cent	164,000*	10,000†	...

* Value of buildings of the university and college used in common.
† Value of apparatus of the university and college used in common.

Statistics for 1872 of the industrial institutions of the United States which have received

Number of States having industrial institutions.	Location of the institution. State.	Town.	Number of industrial institutions.	Name of the institution.
1	Alabama	Auburn	1	Agricultural and Mechanical College of Alabama
2	Arkansas	Fayetteville	2	Arkansas Industrial University
3	California	Oakland	3	University of California—Agricultural, Mining, and Mechanic Arts College.
4	Connecticut	New Haven	4	Yale College—Sheffield Scientific School
5	Delaware	Newark	5	Delaware College
6	Florida		6	Florida State Agricultural College*
7	Georgia	Athens	7	University of Georgia: Georgia State College of Agriculture and the Mechanic Arts.
		Dahlonega		University of Georgia: North Georgia Agricultural College.*
8	Illinois	Urbana	8	Illinois Industrial University
9	Indiana	La Fayette	9	Purdue University—Agricultural College*
10	Iowa	Ames	10	Iowa State Agricultural College
11	Kansas	Manhattan	11	Kansas State Agricultural College
12	Kentucky	Lexington	12	Kentucky University—Agricultural and Mechanical College.
	Louisiana		....	(1. No industrial institution established in the State)
13	Maine	Orono	13	Maine State College of Agriculture and the Mechanic Arts.
14	Maryland	Near Hyattsville	14	Maryland Agricultural College
15	Massachusetts	Boston	15	Massachusetts Institute of Technology
		Amherst	16	Massachusetts Agricultural College
16	Michigan	Lansing	17	Michigan State Agricultural College
17	Minnesota	Minneapolis	18	University of Minnesota: College of Agriculture. College of the Mechanic Arts.
18	Mississippi	Oxford	19	University of Mississippi—College of Agriculture and the Mechanic Arts.
		Rodney	20	Alcorn University
19	Missouri	Columbia	21	University of Missouri: Agricultural and Mechanical College.
		Rollo		University of Missouri: School of Mines and Metallurgy.
20	Nebraska	Lincoln	22	University of Nebraska—College of Agriculture
	Nevada		....	(2. No industrial institution established in the State)
21	New Hampshire	Hanover	23	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts.
22	New Jersey	New Brunswick	24	Rutgers College—Scientific School
23	New York	Ithaca	25	Cornell University—Industrial Colleges
24	North Carolina	Chapel Hill	26	University of North Carolina—Agricultural and Mechanical College.*
25	Ohio	Columbus	27	Ohio Agricultural and Mechanical College.*
26	Oregon	Corvallis	28	Corvallis College—State Agricultural College of Oregon.
27	Pennsylvania	Centre County	29	Agricultural College of Pennsylvania
28	Rhode Island	Providence	30	Brown University—Agricultural and Scientific Department.
29	South Carolina	Orangeburgh	31	Claflin University—South Carolina Agricultural College and Mechanics' Institute.
30	Tennessee	Knoxville	32	East Tennessee University—Tennessee Agricultural College.
31	Texas	Bryan	33	Agricultural and Mechanical College of Texas*
32	Vermont	Burlington	34	University of Vermont and State Agricultural College
33	Virginia	Blacksburgh	35	Virginia Agricultural and Mechanical College
		Hampton	36	Hampton Normal and Agricultural Institute
34	West Virginia	Morgantown	37	West Virginia University—Agricultural Department
35	Wisconsin	Madison	38	University of Wisconsin—College of Arts

* The college is not opened.

the national endowment of land-scrip under the act of July 2, 1862—Continued.

Number of acres in the agricultural and mechanical college farm.	Number of acres in agricultural and mechanical college farm cultivated with plowed crops.	Number of volumes in the agricultural and mechanical college library.	Name of the president of the agricultural and mechanical college and of the university.	Number of professors and assistants in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college for the collegiate year.	Number of students in the university and agricultural and mechanical college for the collegiate year.
200	....	1,000	Rev. I. T. Tichenor, D. D	8	103	....
160	39	300	N. P. Gates, A. M	3	....	183
200	....	500	Daniel C. Gilman, A. M	11	....	....
No farm.	....	10,000	Rev. Noah Porter, D. D., LL. D	27	157	809
70	33	8,000	William H. Purnell, A. M	10	....	....
No farm.	....	....	Hon. Charles Beecher, pres. of directors	....	....	....
No farm.	....	*13,000	Rev. A. A. Lipscomb, D. D., chancellor	11	126	250
70	....	....		2	....	....
623	214	8,108	John M. Gregory, LL. D., regent	22	194	381
184	....	....	John Purdue, president of trustees	....	....	....
870	160	3,000	A. S. Welch, LL. D	17	....	....
415	100	3,000	Rev. Joseph Denison, D. D	10	....	....
433	120	*20,000	John B. Bowman, A. M., regent	13	....	....
....	....	....	....	....	....	....
370	17	1,500	Rev. Charles F. Allen, D. D	11	....	....
270	102	....	Rev. Samuel Regester, D. D	9	171	....
....	....	....	John D. Runkle, Ph. D., LL. D	34	356	....
383	43	1,500	William S. Clark, Ph. D	36	152	....
676	88	3,300	T. C. Abbot, LL. D	13	131	....
143	30	....	William W. Folwell, M. A	12	117	354
....	....	....				
110	20	....	Rev. John N. Waddel, D. D., chancellor	13	....	....
200	....	....	Hon. H. R. Revels	....	....	112
600	60	200	Daniel Read, LL. D	13	58	....
....	....	....		4	28	322
480	20	....	Allen R. Benton, LL. D., chancellor	7	25	130
....	....	....	....	....	....	....
163	8	1,200	Rev. Asa D. Smith, D. D., LL. D	9	23	408
99	72	10,000	Rev. William H. Campbell, DD., LL. D.	11	50	194
200	127	*36,000	Andrew D. White, LL. D	30	207	525
No farm.	....	....	Rev. Solomon Pool, president of the university.	....	....	....
320	....	300	Hon. Joseph Sullivant, sec'y of trustees	....	....	....
36	24	400	B. L. Arnold, A. M	5	22	165
600	....	800	Rev. James Calder, D. D	10	150	....
No farm.	....	*38,000	Rev. E. G. Robinson, D. D., LL. D	9	27	204
116	25	....	Rev. A. Webster, D. D	4	....	108
260	70	500	Rev. Thomas W. Humes, S. T. D	10	38	228
800	....	....	Hon. H. Schiller Sjberg, sec'y of trustees	....	....	....
No farm.	....	*15,000	Matthew H. Buckham, A. M	6	28	125
244	....	....	C. L. C. Minor, M. A	4	113	....
125	66	200	General S. C. Armstrong	13	213	....
25	5	300	Rev. Alexander Martin, D. D	6	22	159
234	....	*4,600	Rev. J. H. Twombly, D. D	9	93	517

* Number of volumes in the university and college used in common.

RECENT RURAL PUBLICATIONS.

THE SCHOOL OF CHEMICAL MANURES; or Elementary Principles in the use of Fertilizing Agents. From the French of M. George Ville, by A. A. Fesquet, chemist.

The above is the title of a work lately issued from the press of Henry Carey Baird, Philadelphia.

But few subjects are of more importance to practical farmers than that treated in this little volume, and the name of Professor Ville, who has so long and successfully managed the French experimental farm at Vincennes, is a sufficient guarantee of its scientific accuracy. The distinguished author of this book appears to aim at harmonizing the conflicting theories of the schools of nitrogenized and of mineral manures.

The agricultural philosophy of Professor Ville divides crops into three groups, over each of which some particular manurial agent exerts a predominating influence. His first class consists of wheat, oats, barley, rye, beets, hemp, &c., on which ammonia and the nitrates exert, in an especial manner, a favorable influence. The crops over which potassa exerts a predominating influence are peas, beans, clover, lucerne, flax, potatoes, &c. The crops especially influenced by phosphates are Indian corn, artichokes, ruta-bagas, turnips, sugar-cane, &c.

We do not understand the author to teach that crops can be produced by either of these agents, in the entire absence of the other elements of plant-nutrition.

By the phrase *predominating influence*, we understand him to mean that a soil holding, in an available form, enough of all the elements which enter into a crop of wheat, for example, will, by a redundancy of nitrogenized manure, give a greatly increased growth to that crop, while no such effect would follow a redundancy of potassa, or phosphoric acid. On the other hand, potassa will give a similar result with clover, and phosphates with Indian corn. He teaches that lime (and he should have added magnesia) is an essential element of plant-food, but does not exert a predominating influence over any particular crop.

Professor Ville, in the third chapter of this work, repeats the hypothesis which he has advanced in several previous publications, in which he assumes that plants, or at least a certain class of them, use atmospheric nitrogen in their nutrition. If by this he means to assert that a plant can use as food nitrogen, or any other form of simple matter—matter which has not been subjected to the action of chemical force—then we are not quite prepared to receive the hypothesis. In proof of his position, the professor calcined a portion of earth so as to expel all nitrogenized substances which may have existed in it; this earth was then mixed with phosphate of lime, potassa, and lime, and watered with pure distilled water. Clover sown in it grew perfectly well, and the crop being analyzed, demonstrated the presence of nitrogen. If he had given us an analysis of the soil after the clover had been produced, and had thus demonstrated that it contained neither ammonia nor nitrates, then his proof would have been conclusive. But it is a fact familiar to every observer that earth which contains alkaline substances, if kept in a state of uniform moisture and exclusion from light, will soon become rich in nitrates, which in turn are available as plant-food. It is worthy of notice that the class of plants to which our author attributes this property of feeding on atmospheric nitrogen, is that class which most completely shuts out the light, and thus induces the condition most favorable to the union of the atmospheric elements to form nitric acid. For

example, a clover-crop, growing on ground which has received a heavy dressing of wood-ashes and lime, will very early in the season produce such a mass of foliage as to screen the soil from the light most effectually, and operate as a very perfect mulch to the earth; thus inducing the prime condition for the formation of nitrates. After all, it may be that Professor Ville means no more than that in this indirect manner plants receive nitrogen from the air. If so, we assent.

But to return: this doctrine of predominating substances has much to recommend it in the practical application of manures. Out of this grows the practice of using special manures for certain crops. The law governing the application of special manures, derived from the experiments of a series of years, is laid down in this work with sufficient clearness to enable any farmer of ordinary intelligence to apply it in practice.

The indiscriminate use of fertilizing agents has been a source of great waste both of labor and money. The first step toward a rational use of manures is to determine what is already in the soil in a sufficient quantity, and what is wanting. On this subject our author very justly remarks, (page 42:) "It has often been thought that chemical analysis would furnish the proper indications, but we are now obliged to give up this hope. The four substances to which the soil owes its fertility are there found in various states—soluble and active, insoluble and inactive. As chemistry has not yet succeeded in making these necessary distinctions, its testimony is not a sufficient guide for agricultural practice." He, therefore, recommends analysis by experimental culture of small lots, each with a different fertilizer; and, by noting the result, a correct conclusion may be reached as to what elements of fertility are deficient in the soil.

While this treatise furnishes the American farmer a clear statement of general principles, and submits valuable formulæ for both special and complete manures, yet it will require a careful discrimination to apply these to the demands of American agriculture. For example, the rotation of crops recommended, (page 72,) and the manures to be used each year, however appropriate they may be in European farming, are almost worthless to us. Any rotation which gives prominence to beets, colza, vetches, and horse-beans, and almost entirely ignores corn, (maize,) is of but little value anywhere in the United States. A farmer, however, who understands the principles upon which the system of rotation is constructed can very readily make such changes and substitutions as will adapt it to his own peculiar circumstances.

The values at which the different ingredients composing the manures recommended are estimated are certainly below the lowest prices in our market. For example, superphosphate of lime, at 16 francs per 100 kilograms, is $1.38 per 100 pounds, or $27.60 per ton, (2,000 pounds,) which is but little more than half its market-value in gold. So, nitrate of potassa is put at $5.35 per 100 pounds; nitrate of soda at $3.02, and sulphate of ammonia at $3.88 per 100 pounds.

In estimating the cost of chemical manures, our farmers must take into the account this disparity, and make their calculations accordingly. But even at this low estimate the cost of fertilizers in the rotations of crops recommended by Professor Ville will be apt to startle American farmers. In his several rotations for grain-crops, the annual expense for manures ranges from 200 francs per hectare, down to 165; which, in good Saxon English, is from $15.38 to $12.69 per acre. If we add to this 33 per cent. for the difference in price of the articles used, the amount will probably, at the present price of farm-products, deter most farmers from following this leading. It will be remembered, however,

that these estimates are made for soils that are completely exhausted; a condition in which, fortunately, but few of our American fields are found. We may, therefore, safely reduce the quantity per acre in proportion to the elements of fertility already in the soil. Scarcely an instance will occur in our country where it will be necessary or proper to depend exclusively on artificial manures. If due care be observed, the stable and barn-yard will always furnish the chief supply of manure to the American farmer, and chemical manures will be used only as auxiliaries to supply the mineral elements lost in the grain and other products sold from the farm. Used for this purpose, and in conjunction with barn-yard manure, the cost of chemical fertilizers necessary will be greatly reduced.

The practical value of this book is impaired by the mistake of the translator in not rendering the French weights, measures, and values into English. With the intention of remedying this defect, a table of English equivalents is appended to the preface, but this will not serve the purpose with the mass of American readers. While we appreciate the importance of familiarizing our people with the decimal system of weights and measures, now adopted by most European nations, yet we think the better way to do this will be to present the corresponding values together, so that the eye can catch them at once. If the translator had carried out on the same line in his table of kilograms, hectares, and francs, their values in pounds, acres, and dollars, he would not only have added much to the value of his book, but he would have contributed directly to a general knowledge of the French system of weights and measures. We hope the publisher will remedy this defect in a subsequent edition; for the work is of too much value to those who desire to understand the philosophy of vegetable nutrition to be thrown carelessly aside on account of a minor defect.

FARM-GARDENING AND SEED-GROWING. By Francis Brill, formerly market-gardener and seed-grower at Newark, New Jersey; 12mo, 151 pp. Orange, Judd & Co., New York, 1872.

As its title indicates, this little work contains full instructions in farm or market gardening and seed-growing, and will be found of great value to the amateur gardener. It contains a table giving the proper number of plants or hills which should be grown on an acre of ground, of every vegetable, plant, or vine grown in the market-garden. The author, in his introductory remarks, says:

In preparing this book, I have endeavored to give plain, practical directions, in minute detail, for growing vegetables and seeds, and have aimed to avoid all superfluous matter, which, though it might be interesting to the general reader, would be of no practical benefit to those for whom the work is more specially designed. I have deemed it advisable to dispense with illustrations, which I admit are useful, to a certain extent, in giving to the reader a more vivid idea of the form and general appearance of the subject under consideration; but in these days of enterprise, almost every seedsman's catalogue, as well as the works on gardening which have preceded this, and the agricultural and horticultural journals, contain complete illustrations of all leading vegetables, implements, &c.

THE AMERICAN VINE-DRESSER'S GUIDE. New and revised edition. By Alphonse Laubot; 12mo, 123 pp. D. Appleton & Co., Broadway, New York, 1872.

This work is printed in both the English and French languages, and contains some information which will be found valuable to grape-growers.

THE ORANGE COUNTY STUD BOOK, giving a history of all noted stallions bred and raised in Orange County, New York, together with symptoms and treatment of the disease of the horse; 12mo, 160 pp. By J. H. Reeves, veterinary surgeon. Published by the author, Unionville, Orange County, New York, 1872.

To horse-breeders and horse-fanciers this work will prove of interest

and value. It contains a history of the celebrated horse Hambletonian, together with an account of the achievements of some of his more prominent colts. Other noted stallions of this county are mentioned, and their history and pedigrees given. The work also contains extended chapters on "The Breeding and Management of Colts," "The Vices and Disagreeable or Dangerous Habits of the Horse," "Operations," and "Diseases," concluding with a list of medicines and recipes used in the treatment of the diseases of the horse.

A PRACTICAL TREATISE ON THE LAW OF HORSES, embracing the law of bargain, sale, and warranty of horses and other live stock; the rule as to unsoundness and vice and the responsibility of the proprietors of livery, auction, and sale stables, inn, keepers, veterinary surgeons, and farriers. By M. D. Hanover; 8vo, 245 pp. Robert Clarke & Co., Cincinnati, 1872.

In the preface to this work, the author says he has chiefly sought to investigate the principles which constitute the law of warranty in the sale of horses, and to present them in a clear and concise form. Contracts, frauds, and other branches of the law have also been treated of, so far as they relate to the bargain and sale of horses and other live stock.

The rule as to unsoundness and vice in horses, the responsibility of inn-keepers, livery-stable keepers, and others having care of horses, have also been carefully presented. The aim of the author seems to have been to afford assistance to the lawyer and at the same time enable the unprofessional reader to gain a general acquaintance with the law upon the subject. The indexes are comprehensive and conveniently arranged, both alphabetically and by sections.

ON THE MANAGEMENT OF THE DAIRY. By C. F. Raddatz, professor of German and history, Baltimore City College; 12mo, 46 pp. Baltimore, Sun office, 1872.

This work contains, in a clear and concise form, directions for the proper management of the dairy as it relates to butter-making. The first point considered by the writer is the proper grazing and feeding of cows, and the conditions under which they should be milked. The milk is then followed in its various stages to the churn, and the butter from the churn through all its manipulations of working, salting, and packing for market. The oft-repeated complaint that good butter for keeping can hardly be obtained, has induced the writer to prepare this treatise. It is dedicated to the Hon. Horace Greeley as a token of appreciation of the great efforts made by him to improve agriculture in the United States.

PROGRESSIVE BEE CULTURE: Being a treatise on Apine Instincts and Labors Defined, Illustrated and systematized upon a new theory. By D. L. Adair, Hawesville, Kentucky. 8vo, 24 pages. Published by the author: 1872.

The author, in illustrating the great progress made in bee culture, mentions the fact that twenty years ago, when the movable comb system was first introduced, those who adopted it thought they had reached perfection. At that time the yield of honey from a single hive of bees did not exceed fifty pounds. Now, large apiaries have been made to yield several hundred pounds of honey per annum from single hives, while individual colonies have been known to produce from 500 to 700 pounds. At a meeting of the North American Bee Keeper's Society, held in December, 1871, one member offered to sell a large number of hives, to be paid for only on condition that he should, during the season of 1872, take ten colonies containing a quart of bees each, and from them secure 10,000 pounds of honey, or at the rate of 1,000 pounds per hive.

The writer asserts that bees do not possess reasoning powers, notwith-

standing the contrary assertion by many eminent naturalists. They are governed by immutable laws from which it is impossible for them to swerve or deviate. He says:

The evidences of design are not less perfect in the regular workings of the honey-bee. They are reducible to certain rules that are as unvarying as the laws governing the mathematical sciences, for it is but reasonable to conclude, from the known regularity of such of their peculiarities as we have been able to comprehend, that such as have been considered so irregular as to induce the belief that they were the result of reason, are governed by the same immutable laws.

We find in every normal colony of bees one bee called generally a queen, a name we consider unfortunate, as it conveys a wrong impression of the office she performs in the hive. She is simply the mother bee, with no attribute of royalty, and exercises no control over anything therein. She has certain organs called ovaries, in which eggs are produced in a manner not substantially different from the seeds in the capsules of the poppy, or in the fruit of the tomato. Under certain conditions the eggs grow, and when perfected in size and elements, they are cast off like seeds and are ejected into cells. If the queen is perfect she has a little sac, which has been named spermatheca, in which is contained the seminal fluid. The eggs, when being laid, in passing its mouth absorb small particles or filaments of this fluid, through minute holes, and are thus said to be fecundated. In a normal colony such eggs always produce worker-bees, and although from the same eggs queens may be produced, it is only done when there is some derangement in the proper balance of the hive, and consequently is abnormal.

The writer treats of the general cause of the production of drones and queens, of the parthenogenesis and agamic reproduction of bees, how the queen starts her brood-nest, bee-bread, the life of a bee, the effects of want of room, &c.

Annals of Bee Culture for 1872: A Bee-Keeper's Year-Book, containing communications from the best American Apiarians and Naturalists. By D. L. Adair, Hawesville, Kentucky. 8vo, 64 pages. John P. Morton & Co., Louisville, Ky., 1872.

Among the more important articles in this pamphlet the following are worthy of enumeration: "The Genesis of the Honey-Bee," by D. L. Adair; "Fertilizing Queens in Confinement," by Mrs. E. S. Tupper; "Apiculture in Agricultural Colleges," by Professor A. J. Cook; "The South as a Bee Country," by S. W. Cole; "What are the most desirable Improvements in Bee Culture?" by Charles Dadant; "The Essentials of Bee-Keeping," by Dr. Jewell Davis; "Why newly-hived Swarms desert," by E. Gallop; and the "Size of Bees and their Cells," by D. L. Adair.

Healthy Houses: A handbook to the history, defects, and remedies of drainage, ventilation, warming, and kindred subjects. By William Eassie, C. E., F. L. S., F. G. S., &c., late assistant-engineer in the Crimean War. 224 pp., 12mo. New York: D. Appleton & Co., 1872.

This is a very valuable little work, and should be in the hands of every one who contemplates erecting a house for a home. It is profusely illustrated with all the improved designs for drainage, heating, and ventilating. The work is not given forth by the author as an original production; it is simply intended as a record of facts—of acquired experiences and established inventions in relation to house construction, given under the impression that they are required by the annually increasing number of persons driven to build homes, or to remedy defects in those built for them by others. The author, in his introductory chapter, gives the following description of unhealthy residences:

A residence in which unhealthiness reaches about its *maximum* may be said to be one which is built on a damp site with higher ground behind pouring down its waters against walls without areas—walls innocent of a damp-proof course to arrest the rising wet—and walls, likely enough, also exposed by insufficient thickness to driving rains. It may be in the neighborhood of low-lying fields, undug, unditched, undrained, or with the tiles long since choked up. The rooms throughout are low, with a hap-hazard ventilation, insufficiently furnished with windows, and with perhaps too many doors. The main staircase is without a lantern vent, or the wall there is pierced

by a window not sufficiently high to empty the gasometer overhead. As for the back-stairs, the basement smells climb them *en route* for the dormitories. The chimney flues are also badly constructed, and a smoky atmosphere is all but constant. Overcrowding lends its quota of evils, as press-beds in every available corner testify. The drain-pipes are injudiciously laid inside instead of outside the basement, with leaky joints caused by indifferent luting, and with pipes broken where they pass through the walls, owing to continuous settlement. A foul soakage of the soil around the unpuddled pipes speedily follows. The lead-work is also defective—dishonestly executed with the thinnest material, and badly junctioned to the drains; or if once properly performed, the maintenance of that state of things is neglected from ignorance or parsimony. The water-pipes, too, are all built in the brick-work or buried deep in plaster, a burst pipe soon causing the walls to resemble a huge sheet of wet blotting-paper. As for the sinks, they are far too numerous, and made to perform improper services. The scullery traps have long ago lost their gratings, and are filled up with grease or other refuse. Up-stairs the waste pipes of the lavatory and of the bath are connected direct with the sewer. There is, moreover, only one cistern for the multitudinous necessities of a family. The closets supplied from this same cistern stand directly in the passage, and have only one door; the apparatus is faulty, and the hidden soil-pipe is somewhere imperfect. Ventilation of the drains there was originally none, and none is contemplated; the accumulated gases therefore take the water-trap by storm and invade the atmosphere of the house. Even the flushing of the too flatly laid house drains are unattended to, or left to the periodical downfall of rain through the rain-water pipes, which only serves to stir up the nuisances, not carry them resistlessly away.

If the mansion is situated in the country, there are, perhaps, no drains to flush, no sewers to ventilate; a cess-pool instead receives elemental down-pours, household slops, culinary waste, closet excreta—everything. Moreover, there is no overflow therefrom, save into the surrounding soil. Perchance the house is an ancient one, and connected with old brick sewers, the bulk of them rotten and harboring vermin, who gnaw their way into the rooms, and let in upon the inmates the continually evolving gases of the underground tunnels. These, again, may drain into some gigantic pit, or series of pits, hidden in the grounds, or they may debouch into some festering or open ditches in the meadows below. If newly-laid drains convey the *effete* matters into a sewerage receptacle with a view to utilization in the garden, in all probability they are choked up, and an accumulation ensues which, by and by, ruptures every joint. Of course the tank is not ventilated, and the compressed gases blow through the traps, tainting the very milk in the dairy. The water is in a worse plight: the supply is contaminated and unfiltered, the waste-pipe of the leaden cistern connects unapologetically with the sewer; in other words, there is not even a trapped overflow. Or, the household may be dependent upon a well, the yield of which is nauseous from the infiltration of sewage through a porous soil.

To prevent or remedy the above evils is the design of this work. The author, in a chapter devoted to the subject of sinks, water-closets, &c., while admitting that the dry-earth closet system has some advantages, does not think it can ever come into general use. On this point he says:

I know that there are many who advocate the exclusive use of the earth-closet in our towns and cities. But how would it work? Take, for example, Norwich, with, say 17,000 houses and 75,000 inhabitants. Mr. Broadman calculated that in order to do justice to the system, the town would have to be divided into four first-class and eight second-class districts, and an immediate outlay of £4,600 be made for horses, vans, pails, and drying-kilns. The annual cost of collection and management, with the cost of the earth, would be about £8,500. The estimated profit at 20*s.* per ton, or 6*s.* per individual, would be about £14,500, but this is evidently very much exaggerated.

And what would such a condition of things necessitate? There would be, for instance, 8,000 or 10,000 pails to cart away from the back doors or front areas of the first-class houses at least every third day, and in the second-class districts, where the closets were down stairs, and a fortnight's accumulation could be allowed, there would be about 130 tons of manure and earth to remove daily. This is independent of the return journeys with the dry earth. 'One cannot for a moment consider that any board would undertake such a business as this. I think that it would prefer to wait for the profits which utilization will some day bring, and in the mean time build sewers and push on with the water-carriage system. In favor of the earth-system is undoubtedly what the poor cottager would make by the sale of his soil to the market-gardener, or the reduction of rates which might follow a good management by the authorities. *

* * * The greatest objection to the adoption of the earth-closet in towns is, however, made by Dr. Parks, in questioning that the earth-treatment prevents the

production of the emanations which produce fever and disease. It is admitted that the compost is deodorized, but is it disinfected? Until this can be conclusively shown it would be idle to agitate for its more general use or adoption in our towns and cities. Were it even proved that the pestilential evolutions disappeared with the odor, there must always exist cities too vast for its successful practice. How could we expect that London could set apart 400 acres each year in which to dig three feet deep the 2,000,000 of cubic yards of earth which Mr. Bateman estimates would be required under the earth-closet system? To bring the earth from a distance would be still more undesirable in point of economy.

The work contains chapters on drain-pipes and draining; invert blocks, brick sewers, special pipes, and sewage-tanks; ordinary house-traps, wash-troughs, and basins; yard, gully, and road traps; ventilation of drains and sewers; water-closets and urinals; earth-closets, ash-pits, and ash-closets; disinfection and disinfectants; utilization of sewage; smoke-drainage, roof-gardens, and smoke-sewerage; the water-supply; damp-proofing and fire-proofing; ventilation; heating; cooling ice-houses, &c.

Annual Report of the Commissioner of Agriculture and Arts for the Province of Ontario, (Canada,) for the year 1871. 12mo., 450 pages.

This work contains but little, if any, information which would prove of benefit to the agriculturists of the United States. Two-thirds of the work are devoted to statements relating to the finances of the various county and township societies of the province. All the local societies seem to be under the control of the government, to which they are compelled to annually report, both as regards the number of their members and their financial condition. Unlike the admirable yearly reports issued by many of the State societies of this country, this report contains no statements of experiments with grain and root crops—that is, no exact data are given or comparisons made with previous crops. The work contains several well-written and elaborate articles on fruit-culture, and a series of articles on entomology, copiously illustrated.

The early part of the season was extremely dry, and the drought continuing throughout the greater part of the spring, the early crops were seriously injured. During the latter part of June a rainy season set in, which continued for several weeks, seriously damaging fall-crops. There was a good grass-crop, but the rain so interfered with its proper curing that hardly an average crop was saved. It would seem that dairying interests were receiving much more attention than formerly. Many additional cheese-factories have recently been established in the province, and a considerable amount of cheese is now exported. A great improvement is also noted in the breeds of horses, cattle, sheep, and hogs.

A case of "sports" in fruit is given, which seems to be quite well authenticated. It is thus alluded to by the officers of the Brant County society in their report to the commissioner:

The past season has been a remarkable one in the production of what are termed "sports" in fruit and cereals. In the garden of Dr. Lawrence, of Paris, we had the strange phenomenon of apples growing spontaneously upon a pear-tree. The apple and pear trees grew in close proximity to each other, and each of them produced a large quantity of blossoms in the spring, but the fruit upon the pear-tree did not form. When Dr. Lawrence gathered his apples in the fall, he was surprised to find two specimens of fruit, resembling apples, upon the branch of the pear-tree nearest to the apple-tree. This fruit was sent to Mr. Thomas Meehan, of Philadelphia, and pronounced by him and other scientific gentlemen to be "pulp, *apple;* stem, cone, and seed, *pear*." Another gentleman in this neighborhood has an apple-tree which, for years past, has produced Spitzenbergs, but this year, without grafting or budding, one branch has produced quite a different species of apple.

Among several interesting articles on fruit-culture is one contributed by J. H. Springler, on the proper treatment of young pear-trees. The

climate of Canada being similar to that of some of our more northern States, we quote this gentleman's remarks as follows on the overstimulating of young pear-trees:

In the first place, the nurseryman endeavors, by high manuring and cultivation, to have his trees fit for sale at two, or most, three years from the bud, and his trees are as large as they ought to be at twice that age. These, frothy half-ripened things are sent all over the country. The parties who buy them read up on the subject of horticulture; they learn of the immense progress trees make with high culture and manuring, and they saturate their ground with rich, stimulating manure. In a season or two the roots have got fully established, and a strong, rapid growth follows, very delightful to look at, but which the succeeding winter will certainly destroy.

In consequence of this overstimulating method of cultivation, the pear-trees which looked so promising in the fall are perfectly hideous in the spring following, and, if not killed outright, the half-ripened wood speedily decays, and the trees die of old age before they are out of their "teens." I have no hesitation in asserting that in this northern climate 90 per cent. of all the pear-trees which are planted *and grow*, die from manuring, alone; whereas, by planting in well-drained ground which has only been enriched by the rain, snow, decayed foliage, and air, pear-trees will grow slowly, but they will be sound and healthy; and when they arrive at bearing-condition, by top-dressing them every fall with a compost of lime, wood-ashes, and bone-dust, increasing the quantity as the trees bear more profusely, the varieties suitable to the climate will be sure to do well.

THE UNITY OF LAW; as exhibited in the relations of physical, social, mental, and moral science.—By H. C. Carey, Philadelphia, 1872. 8 vo. 473 pp.

In this work the distinguished political economist demonstrates the necessity as well as the possibility of national or State dependence upon self-resource. In the most comprehensive manner he treats of man as the subject of social science; of physical and social laws; of societary organization; of matter and mind; of mind and morals; of civilization, and of scientific relations. He shows that agriculture and manufactures should be interdependent, and that to the extremest possible extent the nation ought upon itself to depend for both these elements of national wealth. Relative to the processes of agriculture Mr. Carey well says that man is but making a machine which supports him while engaged in making it; that "the more time and mind he devotes to the development of the powers of the earth, the greater must be his power of production; and that the more rapidly the consumption of food follows its production, the more prompt will be the reproduction of the elements required for new supplies thereof."

The undoubted conclusion is that greater attention ought to be paid to the conversion of material raised from the soil into valuable form, thereby stimulating production and adding to the proceeds of industry.

It is the argument, and a just one, that the wealth from this source to the country can scarcely be estimated. Let industrial employments be more sedulously cared for, and the prosperity of the country will be the more certain.

Referring to the very bad effects of an exclusive agriculture, the creation of material for shipment abroad when it could be utilized at home, Mr. Carey quotes from a journal of the day, as follows, especially relating to the coffee-trade:

Since the emancipation of the negroes in Jamaica, where formerly large crops were gathered, coffee-culture has almost entirely ceased. Cuba has changed from coffee to sugar, though that island has exported as high as 15,000 tons per annum. The production in the French colonies has almost ceased, amounting to less than 200 tons per annum. Saint Domingo's production, in consequence of the disorganized condition of public affairs there, is also yearly decreasing. Porto Rico yields gradually less every year, while the plantations of Surinam, Berbice, and Demerara have not been worked for several years. Venezuela maintains about an average crop, but cannot be counted on for any portion of the increase necessary to meet an increased demand. Maracaibo produced 2,500 tons in 1867, and may be counted upon for something near that figure constantly. Trinidad orchards are worn out and abandoned. Coro and Curaçoa pro-

duce an insignificant quantity. It was at one time supposed that Costa Rica would become a large exporter of coffee, but the scarcity of capital and hands has reduced the quantity expected from that quarter very much. Brazil has unquestionably reached her maximum production, and will not average more than two millions of bags per year, during any decade of ten years, with the probability of falling below that figure, owing to the edicts of emancipation promulgated there recently. In Ceylon there is probably some increase. The production of Manilla is steadily, though slowly, on the decline. In Hindostan English energy and capital are employed in planting hundreds of new orchards, but the result is in the future. In Java and Sumatra the cultivation depends upon the forced labor of the inhabitants, who are not allowed to participate in the profits; hence the supply has reached its maximum, and it is maintained at its present height with the greatest difficulty. In Liberia a number of coffee-orchards have been planted, and a source of new supply, of more or less extent, will in time come into being. In the mean time consumption increases at the rate of 20 per cent. in this country, and 10 per cent. counting the civilized nations of the world; and higher prices and adulteration seem almost certain to follow.

Mr. Carey has certainly given us a work of valuable deductions, and not among the least of these is this, that the interests of agriculture and manufacture must be codependent.

CHRONOLOGICAL AND STATISTICAL HISTORY OF COTTON. By E. J. Donnell. 8vo., 650 pages. James Sutton & Co., New York: 1872.

This work contains a mass of valuable statistics, the compilation of which required long and patient research. A careful chronological history of the cotton-plant is given, from the period of its discovery as a fiber-plant up to the present time. Copious statistics relating to its production, manufacture, and consumption in many different countries, are also given, together with tables showing the prices paid, and the variety or quality of the fiber sold, during a long series of years, at the more prominent cotton-centers of the world.

In speaking of the immense interests involved in the cotton-trade, the author states that in the United States and Europe, at the present time, there are manufactured about 7,000,000 bales annually, averaging not far from 400 pounds per bale. For this, the producers receive about $400,000,000, gold value. When this cotton is manufactured, and ultimately sold to the consumers in all parts of the world, it has risen in market value to probably sixfold its original cost, leaving to the merchants, ship-owners, manufacturers, and tax-receivers not less than $2,000,000,000 per annum, as remuneration for their capital and labor.

TESTS OF DEPARTMENT SEEDS.

The kinds and quantities of seeds distributed by this Department during the year 1872 are exhibited in the following statement:

Tabular statement showing the quantity and kinds of seeds issued from the Seed Division during the year 1872.

Names of seeds.	Senators and members Congress.	Agricultural societies.	Statistical correspondents.	Meteorological observers.	Miscellaneous applicants.	Grand total.
Vegetables, 218 varieties .... papers..	145, 105	93, 458	75, 455	12, 982	150, 662	477, 662
Flowers, 180 varieties .... do....	76, 234	25, 680	10, 900	7, 030	76, 965	196, 809
Herbs, 12 varieties .... do....	3, 967				759	4, 726
Tree and evergreen, 50 varieties ...... do....	68				1, 471	1, 539
FIELD SEEDS.						
Wheat, 4 varieties .... quarts..	12, 805	8, 744	10, 300		5, 775	37, 624
Oats, 4 varieties .... do....	4, 559	7, 150	5, 296		4, 105	21, 020
Barley, 3 varieties .... do....	2, 195	3, 452	1, 348		1, 712	8, 707
Rye, 1 variety .... do....	796		3, 080		278	4, 154
Buckwheat .... do....	1, 956	240	2, 952		34	5, 182
Field corn, 2 varieties .... do....	345	1, 200	828		1, 615	3, 988
peas .... pints..	603	2, 224	1, 674		838	5, 339
Grass-seeds, 5 varieties .... quarts..	2, 070	16	4		1, 766	3, 856
Clover, 7 varieties .... pints..	956	248			934	2, 138
Tobacco, 4 varieties .... papers..	21, 835	4, 204	140		5, 485	31, 664
Sugar-beet, 2 varieties .... pints..	81	4, 210			474	4, 765
Mangel-wurzel, 4 varieties .... do....	53	2, 454			472	2, 979
Vetches or tares .... do....					163	163
Osage orange .... papers..					74	74
Sorghum .... quarts..	22				205	227
Opium poppy .... papers..	70				435	505
Broom-corn .... do....					24	24
Tea seeds .... do....	30				202	232
Rice .... quarts..			14		21	35
TEXTILES.						
Cotton, 2 varieties .... quarts..	12				550	562
Ramie .... papers..					225	225
Hemp, 2 varieties .... one-half pints..	14	64			47	125
Jute .... do....					237	237
Flax .... quarts..					4	4
Amounts	273, 776	153, 344	111, 901	20, 012	255, 532	814, 565

No labor has been spared nor available sources of information neglected in promoting the usefulness of this branch of the Department's work, assigned to it by Congress—"to procure, propagate, and distribute among the people new and valuable seeds and plants."

It is worthy of note, and gratifying to the Department, that applications for small quantities of improved or superior seeds, with a view to future larger plantings, are constantly increasing, and that so many farmers and planters conscientiously and intelligently report the results of their experiments. Such reports, formerly received by tens, are now received by hundreds. Of these a permanent record is kept by the Department, and the more significant of them reproduced in its monthly or annual publications. These reported experiments serve the double purpose of enlightening the public in regard to the varieties of seeds of the grains, grasses, and other plants best adapted to certain localities, and of guiding the Department in its purchases and distributions. The in-

terests of the farmer are enhanced by this system, and the influence for good of the Department widened. It has been observed that the farming operations of old Europe, conducted on scientific principles, as to the needs of the soil, the quality of the seed, the methods of cultivation, and the selection of means, have produced results to which the general farming of this newer country rarely attains. Mr. J. H. McChesney, in his report on agricultural education in Europe, published in the annual report of the Department for 1868, fairly remarks that "the first and leading fact that arrests the attention of an American observer of agricultural phenomena on visiting Europe is, that in many European countries the annual yield per acre of all the land under cultivation is greatly on the increase from year to year, while in the United States the yield per acre is on the decrease. The question naturally arises, Is this gradual deterioration of American soil proof that Americans are poor farmers, or that our soil is naturally poor? Our soil is the best in the world, and practically we are the most skillful in nearly all the mechanical appliances required in farming. * * * * It was certainly not good farming that permitted the soil of New England, New York, Pennsylvania, and Ohio to deteriorate from a yield of 30 bushels of wheat per acre (and other crops in proportion) to less than 15 bushels; it was not good farming that permitted large portions of the Southern States to become absolutely barren; and it is not good farming that is now permitting the unparalleled soil of our prairie States to grow less and less productive from year to year." As showing the success attending the application of scientific principles in farming in Great Britain, the case is cited of the Marquis of Tweeddale, who, when coming into possession of his estates, found the rental of his land worth only 10*s*. ($2.50) an acre; but through the helps resulting from scientific investigations, the experience of experts, and the sparing of no enterprise in the proper treatment of his soil, raised his entire estate to a degree of productiveness that commanded a yearly rental of £3.10*s*. ($17.50) per acre.

The present consideration of farmers should be the preservation of their lands with relation to productiveness and the character of material produced. If there has been degeneracy of seeds in quality or prolificacy, appliances for restoration must be resorted to, and a more careful system of farming must be followed, a system based upon scientific investigation and gathered experience.

If plant-growth is not supplied with its natural food, there is deterioration; if there is unmindfulness in seed-selection, there must follow degeneracy. It is true that, on account of climatic influences and through immethodical management, seeds deteriorate; that the product of to-day may not be that to-morrow. But the means of change for the better may be said to be patent. Concerning the cultivation of wheat in the wheat-producing region of New York, Mr. Todd, in his American Wheat-Culturist, says:

> In the county of Monroe, thirty or more years ago, raising wheat was attended with remarkably good success. Indeed, wheat was the great staple with farmers for many successive years. Many old farmers with whom I conversed pointed out to me whole farms here and there, and many large fields, where the yield was seldom less than 40 bushels of most beautiful wheat per acre, and in many instances the yield would be 50 bushels. But at the present time, on the same soil, the yield is expressed by any number from 8 to 30 bushels per acre. * * * * Thirty or forty years ago they had all the advantages of a most excellent virgin soil, which was as well adapted to wheat as any other crop, and had there been proper care exercised with reference to keeping the soil in a good state of fertility, by making and applying as much barn-yard manure as was practicable, there never would have been such a decrease in the number of bushels per acre as farmers now talk of.

The case also is cited by the same writer of the progress of wheat-cultivation in the county of Norfolk, England. The average produce was, in 1773, 15 bushels per acre; in 1796, 28 bushels per acre; in 1862, 32 to 36 bushels per acre, the increase being due to drainage, tillage, and to the growth of improved varieties.

Touching the same subject a well-versed writer pertinently says:

If the untaught peasantry of Russia or Hungary grow more wheat per acre than the comparatively educated farmers of the United States, our education is found wanting.

And this covers the ground. It is not wholly the education afforded by books, but, in conjunction, that attained through observation, experience, endurance, which gives great results. The neglect of farmers in regard to seed-selection and labor to maintain their excellence is a matter of serious concern. In view of the well-ascertained degeneracy of varieties of seeds cultivated in many sections of our country, the Department unceasingly devotes itself to the substitution of the fresh and the vigorous. In putting into the hand of the farmer such qualities of seeds and plants as are best adapted to his land and climate, he is, as it were, placed upon his feet and given the opportunity of conducting his operations more advantageously. It must not be forgotten that seed-selection is of primary importance; nor less to be urged, the necessity of rotation of crop and supply of the soil with the elements requisite for the sustenance of particular growth. The means are not without easy avail. Careful husbanding of the resources afforded by nature, and proper appliance, are almost alone necessary for the attainment of results hoped for by the cultivator. Farmers must depend and act upon the fact that it is within themselves to maintain the standard of their seeds, and, of course, the products of them. To look for new varieties constantly, to reach out periodically for new supplies from distant sources, is simply the impolicy of careless husbandry, the result of that thoughtlessness which taketh no care for the morrow. The statement of a contributor to one of our leading current publications is worthy of consideration:

The notion that wheat cannot be improved upon without going off the original farm for seed is against the opinions and practice of the best wheat-growers in the true wheat-countries, such as Central and Western New York. A wheat-raiser there will determine by trial the variety of wheat that he can make most profitable, and he will so handle it in preparing his seed as to secure the large, plump, and perfect kernels, rejecting all that are below the highest standard, and continue from year to year to do this. Some select the heads, one by one, of the most perfect samples, and having secured enough to sow, perhaps, only one acre, they will give the best cultivation to it; and, again, from the product select another bushel, and so go on, until they will have a sample of wheat that will be so improved that it will take the name of the improver, and be ranked in value high above the unimproved. Let the same care and skill be given to the improvement of wheat, by men who live in the best wheat-countries, that has been given to short-horn cattle, and the idea of going anywhere but to these improvers for seed will have no supporters.

Referring to the fact of the rapid deterioration of the soil in Ohio by excessive cropping, and premising the inquiry, "How shall we retain the fertility of our soil?" the Hon. D. C. Richmond, before the agricultural convention of that State for 1871, adduces some practical illustrations from the agriculture of foreign countries which may be weighed with profit:

There is abundant evidence that a country can maintain its fertility from its own sources. For instance, China, which is the best-cultivated country in the world, has naturally a very poor soil, with many of the hill-sides covered with a poor, yellow, hard-pan, the waters of the sea which wash its coast exhibiting a poor clay-color. This country, by the untiring industry of the people, retains its fertility from its own resources, supports its immense population of over 400,000,000, and has continued to

do this for at least many centuries, and perhaps thousands of years. The Chinese grow no weeds, save and use everything that can possibly make manure, and apply it to the land to the best advantage. Nothing is wasted in that country. Very few domestic animals are kept, consequently they have to look to other sources for manure, and human excrement is mostly depended on as a fertilizer. We could learn some valuable lessons from them in the preparation and application of manure. The principle of the earth-closets, now just coming into use in this country, has been in use there probably for centuries.

Referring to his personal observations abroad, Mr. Richmond thought that Belgium was the best-cultivated country in Europe. The land has been tilled over a thousand years, its fertility maintained by resources found at home. Its fields yield 50 bushels of wheat per acre, with other crops in proportion. A great secret of the success is in the economy of the manures.

It is proposed to embrace in as short a compass as possible statements and experiments concerning some of the leading cereals, grasses, &c., distributed by the Department. Experiments of an earlier date than the present year are not referred to.

CEREALS.

Among the varieties of grain introduced by the Department, several have attained established reputations, and have steadily maintained, without noticeable deterioration, the qualities which originally recommended them. Where the value of a cereal to a section, or to the country at large, is fully proved by experiments, and a sufficient time has elapsed to afford opportunity for seed-husbanding, it is left with cultivators to maintain the purity and excellence of the variety by appliances which ought to be known to them, while the Department goes forward in its purpose of instituting tests of still other improved kinds.

During the year three varieties of barley, known as the Chevalier, Saxonian, and Probstier, have been distributed. Their merits have been descanted upon in former reports, since they have been cultivated and carefully experimented with for several years. There has been no variation in the character of reports for the year. They may be considered as varieties well established.

The Scotch rye distributed is also a variety well known and appreciated, especially at the West.

Established varieties of wheat are the Tappahannock, a Virginia winter-wheat, distributed by the Department at intervals since 1862, and the Arnautka, imported from Odessa, Russia, in 1864, an early, hardy, and prolific spring-wheat, distributed annually since that year. Concerning the origin of the valuable native variety known as Tappahannock, Mr. Thomas J. Edge, agricultural editor of the Philadelphia Age, says that some time during May, 1854, Mr. Boughton, of Essex County, Virginia, found in his field a bunch of wheat of such growth as to attract his attention. By marking it he was enabled to watch its growth and progress. At harvest he found it to be a white wheat, at least two weeks earlier than the surrounding red wheat.

The Department, in 1868, introduced from England the Excelsior oat, and from Sweden, in the same year, the White Schönen or Beautiful oat—varieties equaled by few and surpassed by none in the country, in vigor, weight, and adaptability to different latitudes. Experiments reported during the past year are no less favorable in regard to the varieties of wheat and oats here indicated than heretofore; and, indeed, the increased profit and greater satisfaction incident to raising superior

grains have stimulated into exercise the care and ambition of farmers in the direction of seed-selection and careful cultivation.

Great difficulty has been experienced in securing a reliable spring-wheat, either in this country or from Europe. A trial of wheats raised in Oregon, and known by the names of Red and White Australian, has been made in several sections of the Union, but without results to warrant the continuance of their distribution. It has been found that the wheats of the Pacific slope are not well adapted to the Atlantic. Certainly the most reliable spring-wheat up to this time sent out, and the best suited to our wide latitude, is the Arnautka. In view of these facts, its further distribution in those localities most suitable for its propagation has been determined upon, and a new importation ordered.

The introduction of several foreign winter-wheats has not been attended with any considerable success, those from England especially. While doing fairly in isolated instances, the weight of experiments has been against them as wheats calculated for a wide distribution. Among these may be named the Rough Chaff, the Talavera, an Italian wheat which flourished well in England, and the Polish, which also succeeded well there. The importations were made in 1868; but, after repeated trials, the further distribution of these varieties was discontinued.

Among the wheats more recently introduced, and now upon trial, is the FULTZ. It is deemed advisable to state more at length the result of experiments made with this and other cereals more recently introduced, up to this time received.

A historical note of the origin of this wheat was made in the report of the Department for 1871. Satisfied by personal inspection of the grain, and by well-authenticated facts, as to its successful culture in its original locality, that it was a cereal of more than ordinary merit, the Commissioner determined to put it upon trial in the winter-wheat-growing sections of the country. A distribution in small quantities, for experimental purposes, was accordingly made in 1871. The almost uniform success attending experiments warranted a further distribution in 1872. It was desired especially to add an impulse to wheat-culture in the Southern States by furnishing an early, hardy, prolific, and reliable variety, calculated to inspire confidence and stimulate endeavor. The results of experiments have more than equaled expectation. In the experiments which are noted it must be borne in mind that they are, as a general thing, conducted with more than ordinary care, *on small plots*, and yields per acre are *rated*. The yields in some cases may appear unusually large. It is a question for determination by farmers themselves whether or not they can make it "pay" to expend upon a large tract the same energy and skill and a proportional time—raising the productiveness of their fields from 10 and 12 bushels, or even less, to double or more.

As shown by the report of the Department for 1871, the wheat-product of that year in the Southern States, (exclusive of Florida and Louisiana, where wheat is not as a crop grown,) averaged a little more than 8 bushels per acre.

In the light of the experiments with the Fultz wheat reported from a majority of the States of the South, the yield rarely falling below 20 bushels per acre, and generally touching much higher figures, the great possibilities of wheat-culture in that section of our country are apparent, when the conditions of intelligent preparation of soils, the sowing of seeds of ascertained excellence, and faithful effort are complied with.

Experiments with Fultz.—In Baltimore County, Maryland, the yield was double, compared to the standard variety, Mediterranean. It stood

a severe winter better than any other kind. The same hardiness of growth is reported from the county of Montgomery. Reports from six counties, in each case indicate superiority of yield, earliness of maturity, excellence of quality and of weight to the wheat-standard of the section, in one case 66 pounds having been reached, and in another $66\frac{1}{2}$ per bushel.

From Virginia forty experiments have been reported, from nearly as many counties. The accounts are all favorable. The lowest reported yield is 15 bushels per acre, while the average rate touches 30 bushels. Several yields above 40 bushels are reported, one of $66\frac{2}{3}$ bushels. In Scott County it is pronounced to be almost 100 per cent. better than the common varieties. A farmer in Botetourt County reports from $3\frac{1}{2}$ pounds sown the remarkable yield of 333 pounds. The weight of grain has reached 68 pounds per bushel, and 64 pounds is not uncommon.

Seventeen counties in North Carolina have made returns, showing that where the proper conditions in sowing were observed great satisfaction with the variety has resulted. In two cases only reports were unfavorable, and these were consequent upon unusually late sowing, November 20 and February 21. Its adaptation to the soil and climate is not questioned. In Burke County, yield 30 bushels per acre, weighing 65 pounds, superior in all respects to varieties usually grown. Mr. Perry, of Davie County, fertilized with leached ashes and tobacco-stalks, and harvested $13\frac{1}{2}$ bushels per acre, weighing $62\frac{1}{2}$ pounds per bushel, and says that the land would not have produced 3 bushels without the fertilization.

Success invariable, as far as reported in South Carolina. In Fairfield County it yielded at the rate of 16 bushels per acre, although sown on very poor land. Pronounced hardy, and very productive for the climate.

Reports received from eleven counties in Georgia: In Union County better by 50 per cent. than varieties usually sown. Several yields of 25 bushels per acre are reported. Weight generally above 60 pounds and as high as 65 pounds per bushel.

In Randolph County, Alabama, yield 24 bushels per acre.

To the wants of Texas this wheat seems to be particularly adapted. Yields of 20, 35, and 50 bushels per acre are stated. Withstands rust better than other varieties.

Reports from three counties in Arkansas; all favorable. An experimenter in Columbia County says: "This wheat is superior in every respect to any I have seen in this country; ripens about the same time as the common wheat."

Returns from fourteen counties of Tennessee; all favorable. In the majority of experiments in the fine wheat-growing region of this State, this variety is characterized as among the most successful ever introduced. In Davidson County the average production was rated at 40 bushels per acre, with careful attention. Yields, notwithstanding the unpropitious season of 1871-'72, rarely fell below 20 bushels per acre. In the county of Granger it escaped the midge by which other wheat, including the Tappahannock, was destroyed. In weight it reached 65 pounds.

Is considered by a Braxton County, West Virginia, correspondent well adapted to the climate and soil. In Jefferson County is pronounced 80 per cent. better than the common varieties in yield.

Reports from nine counties of Kentucky: Rated yields per acre, 20, 25, 30, 32, and 48 bushels. Weight, usually above 60 pounds per bushel, and reaching 65 pounds. In the county of Ohio the crop gave fully double the yield of the ordinarily good crop. Mr. H. Newell, Pulaski

County, speaking of his crop of 48 bushels per acre, says: "Land adjoining that on which this wheat was sown made 20 bushels per acre of Alabama red wheat, sown in the same way."

Several experiments in Missouri have resulted favorably. Yields of 30 and 33⅓ bushels are reported. In Franklin County said to be better than "Golden Chaff," the hardiest wheat of that section.

In Belknap County, New Hampshire, the yield was 30 bushels per acre. In Cape May County, New Jersey, yield 31½ bushels per acre. Was about one week earlier than other varieties.

Reports from the Western States are not as numerous as was to be anticipated from the quantity of grain distributed. Statements, however, have been received from a majority of them. In Illinois 26 bushels per acre have been raised, a weight of 64 pounds per bushel noticed, and the yield characterized as better than the common varieties. In Indiana 20, 25, and 27 bushels per acre, and thought to be the best yet introduced to stand the severity of the winters. Ohio, 30 and 20 bushels; heads large; grain plump. Michigan, an experiment resulting in 32 bushels per acre—Barry County. In Iowa it stands the winter well,—Washington County. Two reports from Kansas are not favorable to this wheat. A Mitchell County correspondent says it is not hardy when the ground is exposed in winter to frosts and winds from the lack of a covering of snow—the case in that State.

Touzelle.—A somewhat extended notice was given of this wheat in the annual report for 1871, embracing experiments which clearly prove the variety to be one of great excellence and adapted to those sections where winter-wheat is the more successful, but in which much sturdiness of growth is not requisite. While it has succeeded in New York, Pennsylvania, Indiana, and even in Michigan, it has, in a more marked degree, proved valuable as an acquisition to the South. As described, it is a beardless, white winter-wheat, classed, on account of its native habitat, with Mediterranean. During the present year 300 bushels of this wheat have been distributed. While experimenters have been slow in reporting results, there seems to be no falling off or deterioration in the variety as far as heard from. The wheat has now been on trial about three years.

For experiment Mr. D. B. Alexander, of Culpeper County, Virginia, sowed nine varieties of wheat, and found none equal to the Touzelle. During three years of experiment this variety invariably ripened from six to ten days earlier than any other. Another experimenter in the same county states that last season, 1871–'72, it yielded 50 bushels to the acre, weighing 66 pounds per bushel. A correspondent considers it the best wheat he has tried in Augusta County. Reports show yields, in Amelia County, 32 bushels per acre, when sown November 20; in Albemarle County, 30 bushels. Yield in Delaware, 22 bushels per acre, weighing 60 pounds per bushel.

It is considered the largest and best grain-product in Esmeralda County, Nevada.

The experiments of Mr. Alexander are more at length given in the agricultural columns of the New York World, of date of October 9, 1872. The statement is as follows:

Mr. D. B. Alexander, of Culpeper, Virginia, forwarded samples of Touzelle white winter-wheat, imported from France. He received the seed from the Department of Agriculture in 1869. He has tested it for three years, with complete success. Last season it yielded 50 bushels to the acre, which was weighed in different lots at two commission-houses in Culpeper, the return being from each 66 pounds to the bushel. It is very prolific and remarkably hardy. It is an early variety and branches or stools out splendidly He planted Touzelle 27th of September, 1870, and it ripened June 1,

1871, fully ten days earlier than the Lancaster, with equal chances in soil and cultivation. On one stock twenty-four stalks, with large, well-filled heads, were counted. The straw is very clear and bright. The stalk is pyramidal in shape, and will not lodge. It was treated the same as the general crop of Lancaster. It made a better stand on thin soil than the Lancaster. Touzelle is, undoubtedly, hardy. I would recommend it for sowing in the Northern States.

CORN

Cooley.—In the beginning of the current year the attention of the Department was directed toward the introduction of new varieties of corn, which, with earliness of maturity, exempting them from effects of the frosts of one section and the droughts of another, would combine prolificacy and excellence of quality as food-products. A new variety, known as the Cooley, was distributed to a selected list of farmers in different sections of the country, with a request that very careful experiments should be made and accurate reports of results returned. The origin of the corn, as stated by Mr. Cooley, was, that on his farm, on Manchester Island, Ohio River, he took a small ear of eight-rowed corn that matured quite early, and planted it for roasting-ears near a field of large white corn. The small became crossed, or intermixed, with the large corn. He took the earliest and finest ears of this product and planted the next year, and repeated the operation the following year; since which time he has kept the new variety, thus developed, by itself in cultivation, and claims to have greatly improved its quality, productiveness, and early maturity. He claimed that it would produce as much per acre as any variety, and on an average would mature two months earlier. Reports of experiments made with the Department distribution have been returned from the Eastern, Middle, Western, and Southern States, and are here epitomized.

The Cooley corn cannot prudently be recommended for this latitude; it was killed by frosts in September, in Kennebec County, Maine.

It failed to meet expectations as to earliness and excellence of quality in Franklin County, Vermont.

Growing too large in stalk and being hard to husk, is not considered valuable in Hampden County, Massachusetts.

Considered nearly worthless for culture when compared with the field-corn usually grown. The same is true, says a correspondent, with all varieties grown two or three degrees south. After much experimenting, has found grain grown farther north more adaptable—Merrimac County, New Hampshire.

On account of its superior excellence, is considered a decided acquisition in Mercer County, New Jersey.

Not desirable as a field-corn in comparison to the fine corn of Chester County, Pennsylvania. Another experimenter in same county says, that although it might bear cutting sooner, the fodder is not as large, nor can the yield at all be compared to the common corn. Planted May 13, in Bucks County, was fit for table-use in fifteen weeks, and arrived at full maturity a week later. An experimenter in Delaware County is not favorably impressed with it either in regard to early maturity or yield as a crop.

Being a hard grain, makes an excellent quality of meal; but for general planting is less profitable than the gourd-seed, says a New Castle, Delaware, correspondent. Another, of same county, says it proved to be an excellent corn, maturing ten days earlier than yellow, and about four days earlier than gourd, but the product was not as large as the latter.

Planted May 25, without extra care, was ready for table-use in twelve weeks, and matured in eighteen, in Ogle County, Illinois.. In the county of La Salle the yield was 10 bushels less per acre than other corn. No earlier than the Dent corns, nor any better in quality.

In Orange County, Indiana, was seventeen to nineteen days earlier than the white corn grown in the vicinity, but did not yield as much by 6 or 8 bushels per acre, both treated alike. Not earlier than some other varieties of white-flint in common cultivation, nor equal to some of them in productiveness,—Delaware County. Yield 8 to 10 per cent. less than the common corn, but valuable because it ripens in time to allow the plowing up of corn-stubble for wheat-sowing,—Orange County.

In Oakland County, Michigan, was fit for table-use in thirteen weeks, and fully ripened in seventeen; was about two weeks later than common yellow corn planted same day.

Planted in Waukesha County, Wisconsin, May 3, was fit for table-use in eighty-nine days, and for cutting in one hundred and eighteen; not fully ripe until September 20, or one hundred and twenty-eight days. Pronounced a failure by several farmers in Dunn County. In Dodge County, planted May 20, was fit for table-use in twelve weeks, and for the crib in fifteen.

In Des Moines County, Iowa, planted May 23, fully two-thirds of the ears were ripe at the end of fourteen weeks. Satisfied with the variety. Planted May 24, in Mitchell County, was ripe September 20. Ears large and heavy; often two good sound ones to a stalk.

Earlier than any variety ever raised in Baltimore County, Maryland.

Planted April 25, in Albemarle County, Virginia, it was fit for table-use July 20, and was harvested August 19. Another experimenter in same county says it is fit only for table-use in that latitude, and will not produce the amount of forage or grain yielded by the large Southern varieties.

A farmer of Tyrrell County, North Carolina, thinks that two crops can be successfully raised in that State. Planting 7th of May, he had from the product good meal within fourteen weeks. A farmer of Halifax County says it is no earlier, and is less prolific than other varieties.

Matures before the usual summer droughts in Floyd County, Georgia. "Will do for a market-garden corn, but will never take the place of our sweet and field corn, the ears being smaller and the grains flintier." Two reports from Cobb County recommend it for earliness and excellence, but not for quantity of yield as compared with white corn usually grown. Early yields reported in Brooke and Pike Counties; in the latter 25 bushels per acre.

As cited in the monthly report of the Department for July, 1872, Mr. J. D. Wolfe, of Pensacola, Florida, says that he marketed his product two weeks in advance of all other corn, and that for early maturity and productiveness it is unrivaled in that section. On one-sixth of an acre, although the season was unfavorable, he raised one hundred and ten dozen ears of good size, which netted in market $24.75, or at the rate of $148.50 per acre. Mr. Wolfe planted his corn at different times, with reference to having roasting-ears, until the frosts in November. Having planted peas between the rows, he would have, in addition to his corn and pea product, corn-fodder and forage at the rate of two tons to the acre, the ground being cleared in time for a crop of turnips, ready for the market in January. In a subsequent report he states that he planted about the 18th of March; commenced using the corn about 24th of June, and all was pulled by July 15; fully matured by the middle of

August, and leaves dry. It is supposed that in Suwannee County it will with proper care make two crops.

On account of its early maturity is considered an acquisition of great merit in Wilcox County, Alabama.

A statement of Mr. A. J. Wright, of Claiborne County, Mississippi, published in the monthly report for July, 1872, shows that the Cooley corn received from the Department and planted March 8 and March 25, on land of moderate strength, with a slight broadcasting of ashes, plaster, and superphosphate, yielded an abundance of choice roasting-ears by the 10th of June—or about as early as the earliest garden varieties. Planted nearly a month after the Peabody Prolific, it was in roasting-ear ten or twelve days in advance of that variety. "We had some fine varieties of corn from Kansas, and some of the kinds usually planted here, but the 'Cooley' was superior to any of them, except the 'Peabody.'" Reports from three other counties concede material earliness of maturity and great prolificacy. Dr. Compton, of Jackson, is not, however, satisfied that it will do to rely upon for a field-crop.

In the parish of Terre Bonne, Louisiana, it is preferred as an early variety to any other. Planted without extra care in the parish of East Baton Rouge, April 15, the product was ground in twelve weeks and five days. If planted early in March it might mature without a drop of rain. Mr. John L. Slaughter, of New Orleans, states that he planted this corn on well-prepared ground, April 1. One week after it came up a drought set in which continued forty-nine days; yet, notwithstanding this disadvantage, the corn was ready for table-use in about eleven weeks, and fully matured in thirteen. Planted in the parish of Point Coupee, March 12, the crop was gathered the last of June.

Reports received from five counties in Texas, all going to show that this corn meets a desired want. Planted March 18, in Navarre County, there were perfect roasting-ears June 11, and was ready for grinding July 11. Earlier by twenty days than other varieties in Chambers County. A correspondent thinks that if the season is reasonably favorable the Cooley will mature in one hundred days. "It is the very corn for our dry climate, since it will mature before the usual drought sets in." In Williamson County it was planted February 26, and was fit for roasting-ears about the first week in June, and thoroughly ripe about the 1st of July.

Matures at least four weeks earlier than the common corn.—Columbus County, Arkansas. Valuable as an early corn and for its excellent bread-making qualities, but is too hard and small for stock-corn.

A farmer of Hamblen County, Tennessee, says: "Although a small field variety the Cooley is as productive as larger kinds. In this latitude we are visited on an average of two out of every three years with a most scorching and ruinous drought, which sets in first at the time our large field-corn begins to tassel, and the corn is in a great measure ruined. This fatal result is avoided by this variety, which, if planted in anything like good ground between the 1st and 10th of April, will be in full roasting-ear, and even getting hard, before these dry spells set in. It is at least one month earlier than our earliest field-corn."

In the county of Harrison, West Virginia, it matured in about twenty-four weeks. The common corn matures as soon.

Planted on the 5th of May in drills, in rich, mellow soil well prepared; roasting-ears about July 12, and matured in fourteen weeks from time of planting,—Bellevue, Kentucky.

Planted June 10, in Clinton County, Missouri, was ready for table-use in twelve weeks. Yield 46 bushels per acre.

The result of all the information we have regarding this corn is, that it is adapted to a southern climate, because of its early maturity, and its avoiding the drought of August, so prejudicial to the white corn of the South; that while it is not so prolific as the large gourd-seed, it is more certain in its production, and therefore desirable in the Southern States. It has not been successful in the Northern and Middle States, not maturing much earlier than the yellow gourd-seed, and being far less prolific. The Department will therefore continue to test its usefulness by distribution of it, but only in the Southern States.

Pennsylvania yellow corn.—This variety of yellow field-corn has been raised with great success in portions of Eastern Pennsylvania for several years. Early, prolific, hardy, yielding abundance of fodder, it was deemed a variety suitable for the South to take the place of its deteriorated maize. It is a yellow gourd-seed corn with red cob; its ear shaped like the white gourd-seed of the South, but not quite so large, and very much earlier in maturing. It was distributed to some extent last year, and reports from the South are so favorable that the Department proposes to make further distribution this year. It will grow well and prove satisfactory wherever corn grows at all.

In Shenandoah County, Virginia, planted April 29; was harvested September 13, at the rate of 60 bushels per acre. Yield, quality, and time of growth better than the corn commonly grown in the locality. Is about fourteen days earlier.

Planted in Greene County, North Carolina, April 1; harvested in October. Although season was unfavorable, the yield, fifteen days in advance of other varieties, was 30 bushels per acre.

Planted late in South Carolina, in March; gathered by July 15. Was very prolific; ears well filled, and of good size, measuring in length from 9 to 15 inches. It is at least one month earlier than other varieties, and matures before the hot, dry season, supplying the crib at a time of scarcity.

In Pike County, Georgia, yield good, quality excellent, and matures earlier by one month than kinds usually grown. A farmer in the same county says: "It has yielded heavily; I am well pleased with it for several reasons—mainly because of its earliness, having gathered firm, full roasting-ears from it in two and a half months from the time of planting." In Cobb County, planted April 5, and harvested August 13; weight, per measured bushel, 58 pounds. Not as productive as white corn grown in the vicinity.

Experiments in three counties in Florida. Columbia County: Does not yield as largely as the ordinary corn, but matures in twenty days' less time, while the quality is equally good. Madison County: Matures much earlier, and is hard enough for grinding by the time other varieties are in roasting-ear. Two crops may be made in one year. Santa Rosa County: Not as heavy as other corn, but matures three or four weeks earlier.

Reports from five counties of Alabama are highly commendatory of this corn. Autauga County: Excellent in quality, it matures nearly two months earlier than common varieties; some ears 11 inches long. Calhoun County: Ripened early enough to escape the drought. An excellent variety for the climate. Crenshaw County: Matured one month earlier than common corn. Some ears were 12 inches in length. Hale County: Yielded well, ripening six weeks earlier than common corn. Wilcox County: Superior to any yellow corn yet tried.

Is considered valuable in Wayne County, Mississippi, on account of

its earliness, and fair yield on poor land. In Grenada County was from two to three weeks earlier than varieties usually planted.

Four to five weeks earlier than the Creole yellow corn, but the yield not as large, near Baton Rouge, Louisiana.

Reports received from nine counties in Texas. Bexar County: Ready for grinding June 24, four weeks earlier than Texas corn. Hunt County: Planted March 1, and harvested July 30, twenty days in advance of other corn. Yield per acre, 40 bushels. Says a correspondent: "Should this corn retain its qualities without deterioration, I know of nothing of the kind which will further advance the farming interest. It is proof against early drought." Dallas County: Yield per acre, 68 bushels, weighing 58 pounds per measured bushel. Is from three to four weeks earlier than common varieties. Kendall County: A month earlier than other varieties. Victoria County: Two crops may be made. Marion County: Two weeks earlier than other varieties. McLellan County: Yield 25 per cent. larger, and ripened sixteen days earlier than varieties generally cultivated.

GRASSES.

With especial reference to the wants of the South, and to further its awakened interest in more systematized methods of farming, great care has been exercised in procuring suitable seeds of the grasses. The southern agricultural and local press are urging with great warmth and pertinacity the absolute necessity of resort to the grasses for a recuperation of the soils exhausted by exclusive crops and a bad system of labor. As an example of the earnestness of this movement toward improvement, a writer in one of the prominent farm-journals says, speaking of clover, that "a few pounds of diminutive seed furnish machinery to absorb from the atmosphere and pump out of the earth the elements of fertility needed to replace what our wasteful and improvident predecessors have expended. * * * I solemnly believe that, in the benign providence of God, clover is to be the Moses which is to deliver southern agriculturists from the bondage of poverty and debt by restoring our wasted and worn inheritance to its original fertility." Large quantities of the grasses have been sent to the South, and the demands made upon the Department are constantly increasing. Almost exclusively in the South were distributed the *Bromus Schraderi*, an annual, rather coarse, but adapted well to foddering, and Italian rye-grass, (*Lolium perenne*—var. *Italicum*,) and Alfalfa, (*Medicago sativa*.) Red clover (*Trifolium pratense*) in considerable quantities has been sent South and to the farther West. Sufficient time has scarcely elapsed for the return of reports of experiments to any great extent.

A correspondent writing from Prince William County, Virginia, states that farmers have ceased raising tobacco, and determined to adopt a system of crop rotation, and asks that the Department distribute grass-seed in the county, which is well adapted to clover.

A planter of Hale County, Alabama, thinks it will take time to eradicate the prejudices of planters against grass, which they have been fighting all their lives, and that the salvation of the South in great measure depends upon the introduction of cereals and grasses.

Of the Rescue-grass, (*Bromus Schraderi*,) Mr. C. W. Stewart, Montgomery County, Texas, says that it proves to be of great value. Four mules and two milch-cows were pastured on less than two acres of this grass all winter, besides hogs. Using the Rescue, there is a very perceptible difference in the flavor and the quality of butter and milk. A party

who experimented with it has not broken up or plowed the patch since planting—three years ago. The same writer says of Alfalfa, (*Medicago sativa:*) "It was as fine as any common to the Northern and Western States, yielding fine grass, particularly for hogs, since midwinter." A farmer in Alabama has succeeded admirably in his experiments with Italian rye-grass. His beds, prepared March 14, were thickly covered by the middle of June. He has for several years thrown aside exclusive cotton-raising, and resorting to a system of crop rotation, including grasses, has succeeded in raising fair crops of everything planted. An intelligent farmer of South Carolina, referring to his experience of rotating crops in that State, says that clover-seed rolled in with wheat will give a crop of stubble-hay after the wheat comes off, better than corn-fodder for cattle. If the land is good, the clover which stands three years yields a larger profit in hay than can be gained by any other crop. Then clover-sod plowed in and put to corn will give 30 bushels to the acre. Then, after a wheat-crop, let the field stand in clover and rest for three years.

Mr. John B. Cleveland, of the same State, says that, as a general thing, experiments with clover have not been successful; but in view of several instances of very considerable success, he is satisfied that it can be profitably cultivated.

Mr. T. W. Holloway, of Pomaria, same State, says:

"Cotton is king" in the South; but I am pleased to say that this idea is fast giving way to a diversified agriculture, considered as the only means of success in those sections adapted to the growth of grasses. Last May I mowed from two and one-half acres, stiff red upland, 10,000 pounds of fine red-clover hay. This instance of success has induced the purchase by our farmers of over 200 pounds of seed, and so far is likely to prove satisfactory—and the cry now is for red-clover seed.

The culture of red clover is stated to be doing much for the red lands in Greene County, Georgia. A report from San Antonio, Texas, shows that Alfalfa clover grows luxuriantly, being well adapted to the soil and climate. The writer says that he cuts it every two months and feeds it to his young stock. Italian rye-grass has also proved an acquisition. In some parts of Texas, particularly in the stock-growing region, the native grasses are fast disappearing, on account of the vast herds which have pastured on them. Cultivation of other varieties has been rendered imperative since stock-growing is rendered less profitable because feeding must be resorted to. Alfalfa clover grows very copiously. Italian rye-grass is reported upon favorably from Montgomery County. In this county other varieties, also, are being tried, with excellent promise of success.

Mr. J. F. Rollins, of Fort George, Florida, asking for a plant that will take the place of the wild grasses, and furnish stock with forage, recites the fact that he has a large plantation, consisting of an entire sea-island; and says, he is satisfied that many of the old fields now under cultivation would be much more profitable if planted in grass or clover, and devoted to stock, than under the present system of annual crops; and avers that what is true in his case is equally true all over the South.

Italian rye-grass, sown on a deep sandy loam, in Lincoln County, Mississippi, January 13, was ready to cut for hay in May; but was allowed to stand until June with a view to gathering the seed. From the quart sown one bushel and one peck were gathered. The grass does well in that climate, answering well for hay and for green-soiling.

Relating to the new system of culture to which attention is being turned with a view to a redemption of the worn-out fields of the South, and an enhancement of her resources, several examples were given in

the monthly report of the Department for August and September, 1872. An enterprising farmer in Mississippi instituted experiments in raising fruit and in seeding down a portion of his land to grass, both of which were quite successful. His orchard, embracing winter-apples, has already become a source of profit, and his success with grasses constitutes him a strong competitor with the hay-makers of the North. He was especially successful in raising clover, obtaining a growth of three tons to the acre. Other similar experiments in the State confirm the belief that grasses can be successfully cultivated. In Lowndes County, upon a field seeded fifteen years ago to clover, and which has since repeatedly produced both grain and hoed crops, the clover-crop in 1871 was a most luxuriant one, although the field was seeded to clover but the one time.

A writer in the Southern Farm and Home says:

As a forage-plant at the South, lucerne—Alfalfa, (*Medicago sativa*)—is very far superior to all others. It is used for three purposes. First, for feeding green, or soiling; used in this way, it is best to cut the lucerne a day in advance, so as to feed it in a wilted state. *It must never be pastured.* * * * * Lucerne-hay is extremely nutritious, and is relished by horses, cattle, and sheep. It is preferred by the domestic animals to any other kind of hay. The product of lucerne is enormous. Five tons of excellent hay may be cut from an acre. It is estimated that fodder, green and dry, may be obtained from an acre of lucerne for the support of five horses during the entire year. This includes the great bulk of green food during the spring, summer, and autumn.

There is nothing so congenial to the growth of grass as lime; especially in sandy, dry soil; limed soil retains and attracts moisture if anything will. Lime is a large component part of clover.

JUTE.

In addition to the promising accounts of success in the culture of jute in this country, heretofore published, experiments being recent and on a small scale, many others have been received during the present year. These indicate a growing conviction that the cultivation of this valuable fibrous plant will eventually become a profitable industry in the country. Jute has been cultivated successfully in Florida for several years. In Georgia, recent experiment has established in the minds of planters a belief in the feasibility of and profits attending the production of the fiber—the cost of production being small and the cultivation simple. A planter of South Carolina says that the cultivation of sea-island cotton having become precarious, a more certain crop is demanded, and is convinced that jute would prove a proper substitute. Another gentleman of the same State thinks the fact fully demonstrated that jute is a fibrous plant well calculated for growth in the South. In Louisiana, where a company has entered upon the production on a large scale, the ramie-machine is said to be well adapted to the cleaning of jute. Mr. H. H. Stevens, of Massachusetts, well acquainted with the relative merits of jute-products, after comparison, states that the fiber raised in Louisiana, as to length, strength, and color, is fully equal to that of India.

Mr. Thomas H. Dunham, of Boston, to whom, as a competent judge, a sample of our domestic jute-fiber was submitted, writes as follows:

The quality is very superior. The market is just now very much depressed. Some parties here have lost heavily on imported jute-butts, and this season (before the fire) India goods were imported at immense loss. The present rate is 6 to 8 cents per pound, (gold,) the usual rate 10 to 13 cents, (gold.) Your sample is very superior, and at 10 cents (gold) it would be safe to quote. You will understand that our merchants do not favor home-growth of jute, or, rather, make light of it; but my advice to you is to omit no step in pushing forward jute-growth; make every effort to get it raised here. Beyond and above all obstacles, push it on. The country will sustain this to any extent. The motive is greater than you can have any idea of. The moment you get the growth started, you will be fully assured, as capital will follow quickly, as in cotton.

Suppose it were a new growth of cotton, no one would doubt the success, or the aid needed. Our growth of jute will nearly equal half the cotton-crop. We can cut off India supplies, as we have done in cotton.

The interests of our merchants are so interwoven with India importations that they will (as they do) say, "You will never get any quantity grown," and make light of it. But your sample shows that its cultivation is feasible, and it must pay when the market changes. All orders to India are stopped now, and the revulsion will bring jute higher here, within the next year, than it has ever been.

The conductor of experiments at the University of Virginia says, that the Calcutta seed received from the Department was sown April 30, in drills 16 inches apart. In a few days the plants appeared and grew rapidly. Drought set in and continued all summer. The first frost came on the 12th of October, and cut off the plants at the height of 4½ feet.

As heretofore noted, Mr. John A. Bassett, of Salem, Massachusetts, in sending specimens of jute-manufacture, says:

Cotton is baled almost exclusively in gunny-cloth. It requires seven yards to the bale. All this, with the exception of 4,000,000 yards, is imported. The domestic cloth is preferred to the imported, and brings a better price in the market. All the imported cloth is made from long-fiber jute. The use of the butts for cloth-making is the result of improvements in machinery made by Mr. John R. Norfolk, of this city. The value of the importation last year was something over $5,000,000. The outer bark of the jute-plant is difficult to remove, and nothing has yet been devised to supersede hand-labor for this purpose. If the plant is to be cultivated in this country, a machine for this purpose will be indispensable. In India, with labor at a few cents per day, the fiber is produced at less than 1 cent per pound. The average cost of jute-butts here is 4½ cents per pound; long jute, 6 cents. The cloth weighs 2¼ to 2½ pounds to the yard of 45 inches in width. The price ranges from 21 to 35 cents per yard, according to the season in which it is sold. In the bagging season it brings the highest price. The imported cloth is always a few cents cheaper. There are probably not over 200 looms in this country producing this cloth.

The imports of jute-fiber and manufactured articles are not given by the United States Bureau of Statistics in separate form, as distinct from other textile grasses, as will appear from the following

Statement of imports of jute and other grasses, and cocoa-fiber, and manufactures of, during the fiscal years ending, respectively, June 30, 1871, and June 30, 1872.

Articles.	1872.		1871.	
Jute and other grasses, and cocoa-fiber, raw ... tons..	41,851	$2,666,479	26,450	$2,131,056
Manufactures of, by yard .... square yards..	185,357	24,260	228,873	28,556
Gunny-cloth, gunny-bags, and manufactures of, used for bagging .... pounds..	12,137,603	505,566	30,124,466	1,468,902
Other manufactures	....	1,292,515	....	1,734,474
Total value of imports	....	4,488,820	....	5,362,988

From other sources the information is derived that the importations of jute into the United States during the year 1871 were 56,667 bales, (almost wholly from Calcutta, direct,) and 113,146 bales of "butts" and "rejections."

In this country, burlaps, chignons, matting, gunny-cloth, cordage, and coarse house-carpeting are made of jute.

It is within the scope of the purposes of the Department to recommend further experiments in the cultivation of jute, in view of the success of experiments heretofore made, and of the benefits which will accrue to the country from the naturalization of jute-cultivation upon American soil.

VEGETABLES.

During the year, the Department has distributed, in considerable quantities, field and sugar corn, field and garden peas; and for root-crops

mangel-wurzel and sugar-beet, selected with reference more especially to the needs of southern fields. A large number of packages of garden-seeds have been distributed throughout the country. It has been the aim of the Department, with regard to this distribution, to send out a large number of varieties, embracing, as nearly as practicable, the whole range of garden-planting, but to introduce only the most improved kinds of each. The farmers of our country, in the midst of their efforts to acquire money or lands through the agency of big field-crops, are too generally accustomed to neglect or to entirely ignore the garden, which may yield comfort and health, and confer finer texture of brain and muscle upon themselves and families. Hog and hominy, hoe-cake and bacon should *at least* be accompanied by the nutritive and appetizing products of the garden, which nature has provided in such great variety and tempting forms. The vegetable and the flower garden ought to share the care of every tiller of the soil. It is hardly necessary in this place to specify any particular varieties distributed. The number is large, and it may suffice to repeat, that most careful selection is made from improved sorts raised in this country and in Europe. A large number of improved vegetable varieties are imported from England. Flower-seeds are cultivated in France especially for the uses of this Department. The disposition of these seeds, secured as they are generally at considerable cost, must be to some extent circumscribed. Not a tithe of those who apply can be supplied according to their wishes. The Department is emulous of supplying the wants of those sections in which little attention to cultivating good varieties of garden and vegetable seeds has been given, or in which, on account of greater or less remoteness from large and cultivated centers, seeds are difficult to be obtained. The denizen of the town or city, and those having easy access to either, may usually secure roots, plants, and seeds suited to their purpose of usefulness or ornament. Reports received of experiments made with these seeds have been received in great numbers during the past year; and, with very rare exceptions, the very highest satisfaction has been expressed concerning results. The following is only one of very many similar applications coming from South and West; it is from Georgia: "I came here two years ago from New York, to establish a farm, and find it very hard to obtain good seed in this vicinity. Hundreds of freedmen are planting nearly worthless seed, and consequently have poor crops. If we could get a few good varieties of various kinds for garden and field purposes to start with, our crops might soon be improved."

A correspondent having for some time made trial of Department seeds, says: "A very noticeable feature in these seeds received from the Department is the fact that they appear to be fresh and genuine, *and, unlike some* we buy, ALL COME."

TAHITI COTTON.

The attention of the Department was called to the excellence of this cotton by the Hon. George M. Robeson, Secretary of the Navy, early in 1871. With reference to experiment here an order was promptly sent to our consul at Tahiti for a supply of the seed. This was distributed to leading cotton-growers in the South. The Tahiti cotton is evidently a sea-island variety, resembling that of the Fiji Islands in black seed and length and fineness of staple. It is feared, however, that when planted inland it will very much deteriorate. A sample raised from seed furnished by the Department, in Pike County, Mississippi, was sent

by the cultivator to the New Orleans cotton-exchange, and after examination by the committee on classification and quotations, the opinion was expressed that "the staple is long and silky, strongly resembling sea-island, which renders it superior to any cotton hitherto grown on uplands." This sample was raised on soil characterized as "poor pine-woods."

A planter in Tangipahoa Parish, Louisiana, says that this cotton, on good pine-wood land, well manured, will make from 800 to 1,200 pounds to the acre of seed-cotton, and will average about 200 pounds in lint. He says that, compared with upland, it is more difficult to pick, the boll being small and pointed, but; commanding a price per pound at least three times greater, the extra trouble is lost sight of.

Mr. W. Spillman, of Clark County, Mississippi, sends a very beautiful specimen of Tahiti, raised from seed furnished by the Department, and says:

The seed was planted April 22, in ash-colored pine woodland, well subsoiled and but lightly fertilized, and will yield, the present year, notwithstanding the past six weeks' drought and the caterpillar, at the rate of five hundred pounds to the acre. If planted early, and on productive sandy land, it will make an equal yield to that of the ordinary short-lint cotton. It does not mature as early as the common cotton, but appears to stand dry, hot weather much better.

Of this cotton Mr. S. R. Cockrill, of Pine Bluff, Jefferson County, Arkansas, says:

It is sea-island cotton, and resembles your samples from off the coast of Georgia, on the Atlantic, though in a higher latitude. The fiber is very fine and the cotton is a short and distinct staple. Long staples do not succeed in this latitude. The bolls of this variety are small, and the cotton matures very late here, or may not mature at all in ordinary seasons. * * * For short-staple cotton in our latitude, or in any part of the cotton-belt of the United States, except the islands, the multiboll seed is most available and most valuable.

Mr. Dupuy, of Louisiana, says that the cotton from the islands is much lighter in weight, but longer in staple and not of equal whiteness or strength with the common short-staple cotton raised in the South.

The experiments thus far reported go to show that this variety of cotton is worth further testing, and that it may prove a valuable substitute for some of the sorts which have in our southern latitudes materially degenerated. The fact of cotton-seed deterioration being so well established, it is clearly the duty of the Department to ascertain what sorts are well calculated to take the place of seeds little to be relied upon. The effort to afford this supply will be persevered in. It is hardly necessary to call the attention of planters to the importance of making the fairests tests of the seed supplied them.

ORGANIZATION OF SWINE-BREEDING.

The business of swine-breeding in this country has generally been conducted in an unmethodical and unscientific manner. The magnitude of the business, which flourshes here in the home of the maize-plant as nowhere else, has, indeed, stimulated gradual improvement in thriftiness and a profitable symmetry of form; but there has been lacking that persistent care and determined adherence to the principle of breeding which have rendered so successful the best efforts in establishing the most popular existing breeds of cattle.

There are skillful breeders of swine, who have for some time past felt the necessity for organization for consultation, the establishment of facts

bearing upon the history of American swine-breeding, agreement upon the essential characteristics of established breeds, discussion of the status of American breeds in process of formation, and for the possible inauguration of a systematic record for thorough-bred swine. At a meeting of the New York Farmers' Club, December 12, 1871, Colonel Frank D. Curtis, vice-president of the New York Agricultural Society, said upon this subject:

Among the additions which have been made to the rapidly-increasing agricultural literature of the day, none are more important than the Ayrshire and Jersey herd-books. The same necessity which created these, demands a swine herd-book, to protect and foster one of the greatest agricultural interests of this country. When we take into the account that at least 30,000,000 hogs are slaughtered annually, and that the number is rapidly increasing each year, the importance of doing anything to advance this great industry is apparent; and to our view, a swine herd-book, in which a record of all the pure-breed hogs or families in this country may be made, is required to protect the buyer of thorough-bred swine, and as a guarantee of the purity of the blood. If we do not have a herd-book, then we ought to have a record of the points and peculiarities which characterize the different breeds, so explicit and carefully prepared that it shall be authority and constitute a standard by which buyers and breeders as well as judges shall be governed. We have at present no such standard in print, and the whole subject of breeds, and what is thorough-bred, and what marks or features are necessary to constitute a pure breed, and in several cases, the correct names, are almost totally open questions. Under this loose and unreliable system of breeding and sale, grade animals are sold as thorough-breds, and inferior and impure stock are made to increase our herds, bearing fictitious titles, thus causing disappointment to the purchaser as well as loss, and filling a neighborhood or a township with distrust and checking the tide of progress.

There is no remedy for this, except by the adoption of a standard authority, which should be done by the honorable and intelligent breeders of the different varieties in the several States. In order to accomplish this desirable end, and as a preliminary work, I move that a committee of three be appointed to correspond with swine-breeders, with a view, if thought practicable, of calling a convention to consider their interests, and to take such action as may be deemed advisable.

The chairman, Mr. N. C. Ely, appointed as such committee, Frank D. Curtis, of Charlton, Saratoga County, New York; L. A. Chase, office of the Agriculturist, New York; M. C. Weld, Closter, New Jersey. This committee addressed to prominent swine-breeders the following specific inquiries:

First. Would it be useful to breeders to have a scale of points for each breed of swine, made out accurately, in conformity with the views and practices of the best breeders, for the guidance of breeders and of judges at fairs?

Second. Will you prepare, soon, and forward to us, a scale of points for the breed with which you are most familiar, or for more than one, giving a particular description of each "point," as in the scale of points for the various breeds of neat-cattle?

Third. After the views of different breeders, applied to as you now are, have been collected, would you be in favor of calling a convention of the more prominent breeders of each breed, for considering and settling these points authoritatively?

THE NEW YORK CONVENTION.

The interest manifested in the elicited responses induced the calling of a national convention, which met at the Cooper Union, May 14, 1872, and was duly organized by the selection of Henry Stewart as chairman, and Chas. D. Bragdon as secretary. Frank D. Curtis, chairman of the committee on preliminary correspondence, stated the object of the meeting, and read encouraging letters from prominent breeders of all sections of the country. A committee of five was appointed to select committees (of three members each) to report respectively upon the history, characteristics, and a scale of points of each breed of swine bred in America; and also to name a committee of three to report upon "what constitutes thorough-bred swine." This committee included, with the chairman and secretary, Messrs. Weld, Curtis, and

Chase, and was further instructed to consult with breeders throughout the country, and to call another convention, not earlier than November, at some point convenient to the majority of breeders.

It was decided, upon general consultation, to hold the adjourned meeting in Indianapolis, Indiana, November 20, 1872; that it should consist of one delegate at large from each State, and one delegate from each State for each breed of swine raised therein; that these delegates should be named by the State Swine-Breeders' Associations, and, in the absence of such organizations, by conventions of swine-breeders called by the State boards of agriculture or agricultural societies. Care was taken to secure the most impartial representation upon the committees charged with the duty of reporting upon the history and characteristics of the different breeds, that the assurance might be made good that "if the work is well done, it will inaugurate a new era in swine-breeding, and help to protect both swine-breeders and buyers of swine in their mutual relations." The following designation was made:

On "what constitutes thorough-bred swine?"—John P. Reynolds, Chicago, Illinois; Frederick William Stone, Guelph, Ontario; S. L. Goodale, Augusta, Maine.

On Berkshires.—A. B. Allen, New York City; J. T. Hudson, Kansas City, Missouri; Daniel McMillan, Xenia, Ohio.

On Improved Cheshires, or "Jefferson County."—C. V. Maxon, Adams, New York; J. H. Saunders, Sigourney, Iowa; J. J. De Forest, Duanesburgh, New York.

On Chester Whites.—Thomas Wood, Doe Run, Pennsylvania; Dr. Calvin Cutler, Warren, Massachusetts; W. W. Thrasher, Groves, Indiana.

On Essex.—Joseph Harris, Rochester, New York; Dr. A. C. Stephenson, Greencastle, Indiana; George Roach, Hamilton, Ontario.

On Neapolitan.—M. W. Phillips, Memphis, Tennessee; F. D. Curtis, Charlton, Saratoga County, New York; Mason C. Weld, Closter, New Jersey.

On Magie or Poland-China.—John M. Milliken, Hamilton, Ohio; Rankin Baldridge, Hagerstown, Indiana; S. M. Shepard, Charleston, Illinois.

On New Jersey Reds.—David N. Brown, Windsor, New Jersey; David Petit, Salem, New Jersey; John C. Tatum, Woodbury, New Jersey.

On Suffolks and other small white English breeds.—John Wentworth, Chicago, Illinois; John Snell, Edmonton, Ontario; T. L. Harison, Morely, New York.

On Yorkshire and other large white English breeds.—O. P. Cobb, Aurora, Indiana; James Brodie, Rural Hill, New York; M. H. Cochrane, Compton, Quebec.

On Victorias.—Charles Leland, Albany, New York; W. S. King, Minneapolis, Minnesota; George S. Lounsbury, Aiken, South Carolina.

THE INDIANAPOLIS CONVENTION.

The second convention met at the rooms of the State Board of Agriculture, in Indianapolis, November 20, 1872, and was called to order by Mr. Alexander Herron, secretary of the State board, and permanently organized by the election of Dr. A. C. Stevenson, of Indiana, as president, and Mr. George W. Rust, of Illinois, as secretary. Delegates were enrolled from the States of New York, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Missouri, and Texas. Representatives of agricultural papers, and all persons present engaged in the business of swine-breeding, were also admitted to the privileges of the convention.

Several committees having failed to make reports, new committees were made as follows:

On Berkshires.—Professor Jones, of Iowa; Jacob Kennedy and I. N. Barker, of Indiana.

On Suffolks.—Messrs. O. P. Cobb, S. F. Pentecost, and B. Beiler, of Indiana.

On Essex.—Messrs. L. T. Clark, of Illinois; M. H. Cryer, of Ohio; and C. Fletcher, of Indiana.

On Jersey Reds.—Colonel F. D. Curtis, of New York.

For the purpose of historical record, and for future reference of readers of the Agricultural Report, a synopsis of reports upon the history and characteristics of the several breeds, with extracts of the more

essential portions, is here presented. The breeds distinctively American in their origin, (or perhaps the foundation of future breeds,) upon which reports were made, were the Poland-China, Chester White, Victoria, Cheshire, Jersey Red, and Duroc. Of these the favorite hog of the West is the Poland-China. A majority report, written by S. M. Shepard, of Illinois, and Rankin Baldridge, of Indiana, was submitted, and a minority report signed by Hon. John M. Milliken. The former maintains that this breed was fully established in Butler and Warren Counties, Ohio, as early as 1835; that, about 1820, farmers obtained improved hogs bearing the name of Poland, and crossed upon the native stock; that the Byfield was used to some extent, but proving unsatisfactory, a large spotted hog, imported from England, and known as the Big Spotted China, was employed to perfect the breed. It is described as "a medium-sized hog, with short head, good back, full quarters, deep in body, short in neck, fine bone, and possessed of admirable fattening qualities." This infusion of new blood, as is claimed, while diminishing size, increases the fattening tendency, giving symmetry of form and refining the bones. About 1830, a white hog, imported from England as an Irish Grazier, a good feeder, of fair size and great depth of body, was satisfactorily employed in further improvement of this breed. Since 1835, the report claims, no new crosses have been attempted, breeding having been continued by judicious selection of individuals, defects having been eliminated by patient and skillful effort, until "this splendid breed became thoroughly and permanently established, noted for its size, symmetry, docility, early maturity, aptitude to fatten at any age." The characteristics of this Poland-China, or "Magie" hog, as it is sometimes called, are thus stated:

The best specimens have good length, short legs, broad, straight backs, deep sides, flanking well down on the leg, very broad, full, square hams and shoulders, drooping ears, short heads, are wide between the eyes, of spotted or dark color; are hardy, vigorous, and prolific, and when fat are perfect models all over; pre-eminently combining the excellences of both large and small breeds.

For scale of points, we submit the following, making the standard of perfection one hundred, divided as follows:

Short nose, (dished not objectionable,) 4; small head, 4; width between eyes, 4; ear fine, thin, drooping over face, 5; neck, short, thick, and well arched, 4; jowl, large, 3; shoulders, broad and deep, 9; girth around heart, 9; back straight, 6; depth of body, 9; ribs well arched, 9; loin wide and strong, 7; width of body at belly, 5; hams, broad, full, deep, 12; coating fine and thick, 4; legs short and of good strength, 6—100.

Mr. Milliken deemed the scale of points an impracticable feature, in the majority report, and considered the assumed history of the breed erroneous in many particulars. He regarded the name, "Poland-China," a palpable misnomer, but thought a change would cause confusion and disturbance in the relations of capital invested. He knew of no breed called the Poland, and of no importations of Polish swine. He had lived in Butler County, Ohio, since 1807, had an intimate knowledge of the history of the Miami Valley, and had never heard of the Poland hog. He also impugned the correctness of the dates mentioned. While it was assumed that the Poland, Byfield, Big Spotted China, Irish Grazier, and Berkshire, had been commingled in forming this breed, prior to 1835, he stated as a fact that the Berkshire was not introduced until 1835, nor the Irish earlier than 1839, both of which had been crossed and recrossed up to 1842, since which date no new blood had been introduced. He read a statement signed by Cephas Holloway, a prominent member of the Society of Shakers, who had resided in Warren County since 1813, which was published in 1841 in the Western Farmer,

giving a history of the improvement, from which the following extracts are made:

The first introduction of China hogs into this part of Ohio, so far as I have ever heard, was in the year 1816. John Wallace, then a trustee of our society, visited Philadelphia on business in that year, and, while there, was shown what were called "Big China" hogs. He was pleased with their appearance, and purchased one boar and three sows, which were brought the same season to Union Village. The time of the purchase I am able to fix certainly, by subsequent occurrences distinctly remembered.

The boar and two of the sows were entirely white. The other sow had some sandy spots upon her, in which appeared some small black spots. These four hogs were understood to be either imported China or the immediate descendants of imported stock. They and their progeny were extensively used and crossed with the best breeds then existing, and the product of these crosses constituted substantially what was afterward called the "Warren County" hog.

The Berkshires were introduced into Warren County in 1835 or 1836 by Mr. Munson Beach, who operated in connection with his brother, Louis Beach, then a prominent merchant in the city of New York. Subsequently they made other shipments of the same stock to Warren and Butler Counties. The Berkshires, introduced by the Messrs. Beach, were generally black, with occasional marks of white, either on the feet, the tip of the tail, or in the face. They were muscular, active, and round-bodied hogs, and in most cases had sharp-pointed, upright ears. Some families, however, were large in size, deep in their bodies, with ears that lopped.

The Irish Grazier breed of hogs was imported direct into Southwestern Ohio by William Neff, esq., of Cincinnati. My recollection is, that his importation was made in 1839, possibly in 1840. The Graziers were white, with only an occasional sandy spot which appeared about the eyes. Mr. Neff committed some of these hogs to the care of Mr. Anthony Keever, whose farm adjoined our lands on the south. Mr. Keever was a judicious breeder, and esteeming the Grazier highly, he bred them and crossed them liberally.

These two breeds—the Berkshires and Irish Graziers—were extensively used in making crosses by the best breeders in Warren and Butler Counties, and to some extent in Clinton and Hamilton Counties. Having been carefully bred and intermixed with the descendants and crosses of the Big China with other breeds, the stock thus produced constituted the true and original basis of what are now known as the Magie or Poland-China hogs.

He stated further, that subsequently "to the purchase of the Big China, by John Wallace," other China hogs were introduced into the Miami Valley, which were of smaller size, generally with small upright ears, of fine fattening tendency, but not prolific breeders.

The two reports were recommitted to the committee, for a reconciliation of differences, after full consultation and examination of authorities. Mr. Shepard was absent, but Messrs. Milliken and Baldridge agreed upon the minority report, with a recommendation that no change of name be made, as follows:

The history of the breed of swine known as the "Poland-China" breed is as follows:

In the early history of swine-breeding in the Miami Valley, in Ohio, it is clear, from the best written authorities available, and from oral testimony, that there were two breeds which, to a great extent, had been profitably crossed with the common bristled breed of the country. These were the Russian and Byfield breeds. The Bedford breed is also named in connection with the other two; to what extent it was used cannot now be readily determined.

In 1816 we have positive proof from an unquestioned source that the Shakers of Union Village, situate in Warren County, Ohio, and being four miles from Monroe, in Butler County, purchased at Philadelphia one boar and three sows, of what was, at the time, believed to be pure China. They were represented to be either imported, or the immediate descendants of imported stock. They were called "Big China" hogs. These animals were the first China hogs ever brought into Southwestern Ohio. Subsequently other China hogs were introduced and extensively used.

The Shakers and other judicious breeders in Warren and Butler Counties continued to use the breeds at command, and produced, by repeated crosses, a hog of exceedingly fine qualities for that period, which was generally known as the "Warren County" hog. These hogs, continually increasing in good qualities, were bred in both counties, and the very best specimens were carefully and interchangeably used, so as to make the best crosses.

Such was the progress that had been made in forming the ground-work of a good specimen of a hog. This condition of the breed continued until about the year 1835 or

1836, when Mr. Munson Beach, of Warren County, first introduced the Berkshires, which were obtained from C. M. Bement, of the State of New York. Other lots of Berkshires continued to flow into the Miami Valley until about 1841.

The Berkshire blood was liberally infused into the stock existing not only in Southwestern Ohio, but in Kentucky also. Crossing with the Berkshires was almost exclusively done until about 1838 or 1839, when Mr. William Neff, of Cincinnati, imported some choice specimens of the Irish Grazier. This breed soon grew into high favor, and, as a consequence, was liberally used in making crosses with the best specimens of the crosses previously made. This intermingling of blood—this crossing of breeds—continued for some time. In a few years, however, the use of the pure-blooded Berkshire was entirely discontinued, and there were no further importations made of the Irish Grazier. The breeders of swine in the Miami Valley settled down to the conviction that the basis of a good breed of hogs had been established, and that in the future judicious and discriminating breeders could use, and, if necessary, modify the material furnished, so as to meet the highest demands of the public. For more than thirty years no new blood has been introduced into our breed, and no effort made to obtain a new supply of the blood of either breed previously used.

While this is true, our breeders have not been indifferent to the further improvement of our breed. Stimulated by their success, they have perseveringly aimed to improve what they had been so successful in forming. The best points or qualities have been preserved, and, when practicable, have been made even more excellent. All defective points or undesirable qualities have been corrected or improved by the care, skill, and judgment of our experienced breeders.

Thus we have a breed, thoroughly established—of fixed characteristics, of fine style, and of unquestioned good qualities, which can be relied upon for the production of a progeny of like qualities and character.

The following is presented as the characteristics of the foregoing breed: The best specimens have good length, short legs, broad, straight backs, deep sides, flanking well down on the leg, very broad, full, square hams and shoulders, drooping ears, short heads, wide between the eyes, of spotted or dark color; are hardy, vigorous, and prolific, and when fat are perfect models all over, pre-eminently combining the excellences of both large and small breeds.

Chester Whites.—Mr. W. W. Thrasher of Indiana, from the committee on Chester Whites, submitted the following report:

The Chester Whites, as a breed, originated in Chester County, Pennsylvania. The first impulse to the improvement of swine in this county was given by the introduction of a pair of fine pigs, brought from Bedfordshire, England, by Captain James Jeffries, and placed upon his farm near the county-seat, in 1818. Some of the enterprising farmers of the neighborhood were encouraged to commence the improvement of their swine; and by crossing these pigs upon the native white hog of the county, their progeny with the best specimens attainable, and by a course of careful and judicious crossing and selection for many years, the present valuable breed of well-formed, good-sized, easily-fattened, and good bacon-hogs known as Chester Whites was produced and made an established breed. Some twenty-five years ago an attempt was made to introduce into this county the Suffolk and also the Berkshire breeds of swine, and a few of the Chester Whites were crossed with them; but after a few years' trial both were rejected, not being considered any improvement upon the Chesters.

The following may be given as characteristics of these hogs: Head, short and broad between the eyes; ears, thin, projecting forward, and lopping at the point; neck, short and thick; jowl, large; body, lengthy and deep; back, broad; hams, full and deep; legs, short and well set under the body for bearing the weight; coat, thin, white, and straight; (if a little wavy it is no objection.) Small tail and no bristles.

Victorias.—Mr. Charles E. Leland, of New York, from the committee on this breed, made the following report:

The family of pigs known as Victorias originated with Colonel Frank D. Curtis, Kirby Homestead, Charlton, Saratoga County, New York. They were made by crossing the Byfield hogs with the native, in which there was a strain of the Grazers. Subsequent crosses were made with the Yorkshire and Suffolk, the result being a purely white hog of medium size. The name has no significance unless it is intended as a compliment to the English Queen. These pigs, if pure-bred, should all have a direct descent from a sow called Queen Victoria, which may be said to be the mother of the family. She was pronounced by good judges to be almost perfect, and was the winner of a number of first prizes. Breeders in the Eastern States have long felt the need of a medium-sized white hog, with all the good points of the English breeds without their objectionable features, a breed which would mature early, and be covered with a good coat of hair to protect it from the cold in winter and the heat in summer. Colonel Curtis began breeding nearly twenty years ago to try and meet this want. At the

fair of the New York State Agricultural Society, held this year at Elmira, he exhibited a sow, Princess Alice, and six pigs, which was the first time the Victorias have been presented at a State fair for a competition with other swine. The first prize was awarded to the pigs, and the second to the sow.

Characteristics and standard of excellence.—The color is pure white, with a good coat of fine soft hair. The head thin, fine, and closely set on the shoulders. The face slightly dishing. The snout short. The ears erect, small, and very light or thin. The shoulders bulging and deep; legs, short and fine. The back broad, straight, and level, and the body long. The hams round and swelling, and high at the base of the tail, with plaits or folds between the thighs. The tail fine and free from wrinkles or rolls; feathers or rosettes on the back are common. The skin is thin, soft, and elastic. The flesh fine-grained and firm, with small bone and thick side pork. The pigs easily keep in condition and can be made ready for slaughter at any age. These pigs are already in the hands of a number of breeders, mostly in New York, and seem in a fair way to win for themselves a recognition as the swine that shall combine in one breed all the qualities and characteristics which are desirable.

This report was referred to a special committee, consisting of Messrs. G. W. Jones and C. Fletcher, who in their report commended the effort towards the establishment of this breed as another evidence of the ability of the swine-breeders of America to create, by judicious crossing of the pure breeds upon the swine of their respective localities, just such a hog as their climate and commercial interests demand; and they desired to bespeak for the Victorias "a hearty welcome and a fair trial by intelligent breeders of the various States."

Cheshires.—Mr. Curtis, from the committee, submitted the following report on Cheshires, which was accepted:

These hogs originated in Jefferson County, New York; and it is claimed by some of the breeders that they started from a pair of pigs bought of Mr. Wolford, of Albany, New York, which were called Cheshires. However that may be, there is no such distinctive breed of hogs known as Cheshires in England, and there is no record of any hogs of this name having been imported into this country. Yorkshires have been imported into Jefferson County from time to time, and the so-called Cheshires have been improved by crossing with them and hogs bought in Canada. Mr. A. C. Clark, of Henderson, was for a number of years a prominent breeder of these pigs, and he informed us that whenever he found a pig better than his own he purchased it and crossed it upon his own stock. In this way this family of hogs has been produced, and they are now known and bred in many portions of the United States, though their breeding in Jefferson County has diminished during the last two or three years. They are pure white, with a very thin skin, of pink color, with little hair. They are not uniform in this respect, as pigs in the same litter differ widely in the amount of hair. The snout is often long, but very slender and fine. The jowls are plump, and the ear erect, fine, and thin. The shoulders are wide and the hams full. The flesh of these hogs is fine-grained, and they are commended on account of the extra amount of mess-pork in proportion to the amount of offal. The tails of the pigs frequently drop off when young.

Jersey Reds—Durocs.—Mr. Curtis, from the committee, submitted the following report on Jersey-Red and Duroc swine:

The positive origin of this family of swine is unknown. They have been bred in portions of the State of New Jersey for upwards of fifty years, and with many farmers are considered to be a valuable variety. They are of large size and capable of making a heavy growth, 500 and 600 pounds' weight being common.

Mr. David Pettitt, Salem County, New Jersey, has known of these hogs for thirty years, and Mr. D. M. Brown, of Windsor, for nearly fifty years. They are now extensively bred in the middle and southern portions of New Jersey. In neighborhoods they were bred quite uniform, being of a dark-red color; while in other sections they are more sandy and often patched with white. They are probably descended from the old importations of Berkshires, as there is no record of the Tamworth—the red hogs of England—ever having been brought into this country; nor is this likely, as the Tamworth were not considered a valuable breed, and were confined to a limited breeding. The reds resemble the old Berkshires in many respects, but are now much coarser than the improved swine of this breed.

Characteristics.—A good specimen of a Jersey Red should be red in color, with a snout of moderate length, large lop-ears, small head in proportion to the size and length of the body. They should be long in the body, standing high and rangy on their legs; bone coarse, hairy tail and brush, and hair coarse, inclining to bristles on the back.

They are valuable on account of their size and strong constitutions, and capacity for growth. They are not subject to mange.

There is another family of sandy hogs called Durocs, which are bred in Saratoga County, New York, which are finer in the bone and carcass than the Reds. They have been bred with their crosses in this region of country for about twenty years. They are very hardy and grow to a large size.

Among the well-known foreign breeds which are now bred in this country, reports were made upon the following:

Berkshire.—Professor Jones, of Iowa, from the new committee, submitted a report upon this breed, embodying so much of the paper of Mr. Allen, of the original committee, (received during the progress of the convention,) as relates to its origin and history. They have been bred in Berkshire, England, from an early period. The family which was the basis of this breed was of a sandy or buff color, about equally spotted with black, of large size, a slow feeder, maturing at two and a half to three years. It was esteemed for a comparatively greater proportion of lean to fat, and the superior weight of its hams and shoulders, and for the superior fitness of the whole carcass for smoking. Some time during the past century, as tradition affirms, the Siamese boar, then recently imported into England, was fixed upon for the purpose of improving the existing Berkshire. The Siamese is described as varying from a clear jet-black to a dark-slate or rich plum. It was of medium size, quick to mature, fine in all its points, short legs and head, thin jowls, a dished face, slender ears, compact body, well ribbed, extra heavy hams and shoulders, slender tail, thin skin, and firm flesh. This is stated to be the origin of the "farmers' hog," which was an established breed (as stated upon the authority of Mr. John Westbrook, of Pinckney's Green, Byham) in 1780, with all its present characteristics, a hardy, prolific stock, excellent nurses, furnishing meat of excellent quality, the fat and lean well mixed. The following standard of characteristics was fixed upon by the committee:

Color black, with white on feet, face, tip of tail, and an occasional splash of white on the arm. While a small spot of white on some other part of the body does not argue an impurity of blood, yet it is to be discouraged, to the end that uniformity of color may be attained by breeders. White upon one ear, or a bronze or copper spot on some part of the body, argues no impurity, but rather a re-appearing of original colors. Markings of white other than those named above are suspicious, and a pig so marked should be rejected. Face short, fine, and well dished, broad between the eyes. Ears generally almost erect, but sometimes inclining forward with advancing age; small, thin, soft, and showing veins. Jowl full. Neck short and thick. Shoulder short from neck to middling deep from back down. Back broad and straight, or a very little arched. Ribs long and well sprung, giving rotundity of body; short ribs of good length giving breadth and levelness of loin. Hips good length from point of hips to rump. Hams thick, round, and deep, holding their thickness well back and down to the hocks. Tail fine and small, set on high up. Legs short and fine, but straight and very strong, with hoofs erect, legs set wide apart. Size medium. Length medium; extremes are to be avoided. Bone fine and compact. Offal very light. Hair fine and soft; no bristles. Skin pliable.

Suffolks.—Mr. O. P. Cobb, from the committee, submitted a report of this well-known breed, in which the following standard of characteristics was adopted:

Head small, very short; cheeks prominent and full; face dished; snout small and very short; jowl fine. Ears small, thin, upright, soft, and silky. Neck very short and thick, the head appearing almost as if set on front of shoulders; no arching of crest. Chest wide and deep; elbows standing out; brisket wide, but not deep. Shoulders and crop: shoulders thick, rather upright, rounding outwards from top to elbow; crops wide and full. Sides and flanks: ribs well arched out from back, good length between shoulder and ham; flank well filled out, and coming well down at ham. Back broad, level, and straight from crest to tail, not falling off or down at tail. Hams wide and full, well rounded out; twist very wide and full all the way down. Legs and feet: legs small and very short, standing wide apart, in sows just keeping

belly from the ground; bone fine, feet small, hoofs rather spreading. Tail small, long, and tapering. Skin, hair, and color: skin thin, of a pinkish shade, free from color; hair fine and silky, not too thick; color of hair pale yellowish white, perfectly free from any spots or other color. Size small to medium.

Essex.—Mr. M. H. Cryer, from the committee on this breed, reported that the Essex is a black hog, originating in the south of England, small or medium in size, with small soft ears; carcass long, broad, and deep, hams heavy and well let down, bone fine, hair thin. They are remarkable for easy fattening, and are great lard producers. They are fair nurses and prolific breeders.

Neapolitan.—Mr. M. C. Weld submitted a report, in which he says, "It seems strange that a breed of swine, noted, as the Neapolitan is, for possessing qualities of superior excellence, should have been so neglected by American breeders. It is distinguished as the basis of improvement of several of the best breeds of English swine, and produces that striking uniformity of characteristics among different individuals which marks a long-established breed as well as good breeding." He refers to the fact that Martin credits the great improvement of English swine, during thirty years past, chiefly to the agency of the Neapolitan and Chinese breeds. "Like the thorough-bred horse, the Neapolitan has a delicate look, a peculiar grace and stylishness, a look of intelligence, with a vivacity and sprightliness unusual in swine, and which in this breed do not seem to be incompatible with surprising aptitude to lay on flesh, or to grow rapidly on a small amount of food." In the vicinity of New York many gentlemen, who in their travels have eaten the pork of Naples and vicinity, have imported Neapolitans and bred them for their own use, on account of "fine grain and delicious flavor of the pork." The breed is of great antiquity, and imparts its peculiarities with great uniformity. The report claims this as one of the purest and most valuable of known breeds—easily kept, but difficult to keep down in good breeding condition; one of the gentlest and most easily managed, and least fastidious in its food; the sows good mothers, furnishing abundance of milk, and reasonably prolific; furnishing juicy hams and shoulders, well marbled and not coated with masses of fat, abundance of leaf-lard, and the most delicate of side-pork for family use; while the offal is a minimum quantity. The committee adopt the following characteristics:

Head small; forehead bony and flat; face slightly dishing; snout rather long and very slender; ears small, thin, standing outward and forward nearly horizontally, and quite lively; jowls very full, but not large; neck short, broad and heavy above, with a small dew-lap; trunk long, cylindrical, and well ribbed back. Back flat, and ribs arching even in low flesh. Belly horizontal on the lower line. Hind-quarters higher than the fore, but not very much so. Legs very firm, the bones and joints being smaller than those of any other breed. Hams and shoulders well developed and meaty. Tail fine, curled, flat at the extremity, and fringed with hair on each side. General color, slaty or bluish plum-color, with a cast of coppery red. Skin soft and fine, nearly free from hair, which when found upon the sides of the head and behind the forelegs is black and soft and rather long. Flesh firm and elastic to the touch.

Yorkshires.—Mr. O. P. Cobb submitted a report in which this breed is claimed as "the most thorough-bred hog known, and the most valuable to cross from any in the country, for the reasons: 1. They are of a size, shape, and flesh that are desirable for the family or for the packer's use. 2. They have a hardy, vigorous constitution, and a good coat of hair, protecting the skin so well, either in hot or cold weather, that it rarely freezes or blisters. They are very quiet and good grazers; they feed well, and fatten quickly at any age. They are very prolific and good mothers, and the young never vary in color, and so little in shape that their form when matured may be determined in advance by an inspection of the sire and dam."

Lancashire.—Mr. M. H. Cryer, of Ohio, in the absence of the regular committee, was allowed to submit a paper upon this breed, which he classes in families as Large, Short-faced, and Middle. The "Large" variety characterized by great height and length, large bones, the largest breed of swine known; the "Short-faced" noted for shortness between the eyes and end of snout, small bones, a good coat of white hair and skin, square in form, with broad back and hams well let down; the "Middle" partaking of the quality of the small family and the size of the large. He claimed for them aptitude for fattening at any age, a strong constitution, and great power of endurance of heat and cold.

What constitutes thorough-bred swine.—The committee on "What constitutes thorough-bred swine?" Messrs. Roberts, Sprague, and Curtis, submitted the following report:

In the absence of any system of records by which pedigrees of swine are kept, your committee can only give an expression which, from the nature of the case, must be somewhat general. Only such breeds should rank as thorough-bred as are recognized in authentic history as of remote origin, and have steadily been bred in a line, resulting in the establishment of a fixed type, capable of transmitting itself with uniformity. Your committee would recommend that the leading breeders of pure-bred swine form breeders' clubs, for the purpose of establishing herd registries, after the plan adopted by the breeders of thorough-bred cattle, in order to secure greater uniformity, and to perfect, as soon as possible, the various breeds.

The indefiniteness as to the degree of remoteness of origin was explained by Mr. Curtis by the fact that a breed would, in five years, make more progress toward establishment in the hands of some breeders than in twenty years in the hands of others. On the suggestion of Mr. Rust, it was amended to read, "Only such breeds should rank as thorough-bred as are recognized in authentic history as of sufficiently remote origin that when bred in a line it shall result in the establishment of a fixed type, capable of transmitting itself with uniformity."

Scale of points.—Mr. Curtis, from the committee on a scale of points, submitted a scale, which, after modification, was agreed upon as follows:

Back	10	Ear	2
Long ribs	8	Neck	4
Short ribs	7	Belly	4
Shoulder	8	Skin	5
Ham	12	Hair	3
Length of body	6	Bone	3
Flank	6	Legs	3
Twist	6	Feet	2
Snout	4	Tail	1
Jowl	3		
Face	3	Total	100

Classification at fairs.—The committee to suggest a classification of swine at fairs submitted the following report, which was adopted:

1. Berkshires.
2. Poland-Chinas.
3. Cheshires, Chester Whites, large Yorkshires, and other large white breeds.
4. Suffolks, small Yorkshires, Short-faced Lancashires, and other small white breeds.
5. Essex, Neapolitans, and all other black breeds.
6. All crosses, and all other breeds not covered by the foregoing enumerations.

A future convention.—Prior to adjournment, a committee of representatives of this body was appointed to call another convention at such time and place within the next few years as they may deem best. The members designated were Messrs. Frank D. Curtis, of New York; A. C. Moore, of Illinois; J. P. Roberts, of Iowa; John M. Milliken, of Ohio; and Charles Louder, of Indiana.

RECENT FACTS.

FERTILIZERS.

Waste of home resources.—A correspondent of the Southern Farm and Home, speaking of the extravagant use of commercial fertilizers to the neglect of home manures, states that in a recent journey of some extent through the South he found the plantation outhouses crammed with fertilizers. In a very few instances these were bought for cash at $60 to $70 per ton, with heavy outlays, but in the majority of cases the purchases were on time, with the addition of 20 per cent. to cash prices, payment being secured by a factor's acceptance, for which a charge was made of about 2 per cent. per month, the factor receiving a lien on crops, stock, &c. Yet at these plantations no effort was made to save home-made manure; the stable-manure which, if properly cared for, would have equaled several tons of the chemical fertilizers in value, was left uncovered and exposed to the washing of rain till rendered almost worthless.

A New England gentleman writes that during the summer of 1871 he visited the towns in his vicinity for the purpose of observing the current methods of farm management. He found that on a large number of the farms manurial liquids were wholly wasted. More than one-half of the barns were without cellars, and the manure was thrown from their windows into the open yard, where it lay exposed to rains, causing rapid decay of the lower boards and sills of the barn, and losing a very large proportion of its valuable elements. Yet farmers guilty of this waste were buying superphosphate at $60 per ton.

Fertilizers for tobacco.—Mr. James M. Crafts, of Whately, Franklin County, Massachusetts, writes to the Department as follows:

I am one of a company of five persons who, in the last two years, have bought and shipped from Whitehall, New York, over 80 car-loads of horse-manure. Other parties have bought fully as much in Middlebury, Rutland, Montpelier, and Saint Johnsbury, Vermont. The cost at our station has averaged about $10 per cord. Other parties have bought manure from the East Albany cattle-yards—perhaps 50 car-loads in less than two years—all of which, I think, has been sheep-dung. Others have been to New Haven, Connecticut, and still others to Boston and Cambridge; and now two of our farmers have been to Canada and bought 25 car-loads. A car-load of horse-manure contains about 7 cords, perhaps 6½ on the average. This is generally obtained from livery-stables. That from Whitehall, New York, is from stables where canal horses and mules are kept. These are fed highly with grain, and the manure is very valuable. It is used on tobacco-lands at the rate of about 10 cords to the acre. Probably there is no other species of manure which affords in such abundance all the elements of tobacco. It is rich in potash, phosphoric acid, magnesia, &c.

Philadelphia stable-manure.—The Bucks County (Pennsylvania) Intelligencer states that in the spring of 1872 the manure for one year of 725 horses, belonging to Philadelphia street-car stables, was sold at public sale at prices ranging from $12 to $16 per horse; the lower prices on monthly payments, the higher quarterly. Other lots were sold at private sale for $15 per horse. Average yearly amount of manure per horse, 5 tons; average cash expenses for loading, weighing, toll, &c., not including wear and tear of team, 60 cents per ton. A ton of manure, as taken from the stables, will measure about 76 cubic feet. In 1871 the manure from one of the stables cost $2.25 per ton, delivered on the farm. Fourteen tons per acre are applied for potatoes, the subsequent crop of winter-grain receiving no further application. Wheat receives eight tons per acre, and five tons are given as a top-dressing for grass.

Effects of commercial fertilizers in cold soils.—A correspondent in Milton County, Northern Georgia, represents that by the use of commercial fertilizers that county has been rendered as productive in cotton as the southern portion of the State. It is an elevated region, situated on a spur of the Blue Ridge which divides the Mississippi and the Atlantic slope, and the soil is a cold red loam or rotten clay. The stimulating fertilizer gives the cotton-plant an early start, and the weather is seldom, if ever, hot enough to cause it to wither or rust.

Use of kainit.—Professor Voelcker remarks that kainit is more likely to be remunerative on sandy and gravelly than on clayey soils, and especially for roots, clover, and other leguminous crops, and potatoes. For the latter, designed for market, it may also be of use on heavier soils. In moderate applications it may be beneficial to grass-land which does not receive sufficient dung, and which is annually cropped in hay, with the aid of such nitrogenous manures as ammonia salts or nitrate of soda. But he does not anticipate much benefit from a general use of kainit in agriculture.

Management of stable-manure.—In a recent prize essay before the Illinois Agricultural Society, the following method is given for keeping stable-manure in the best condition: In dry weather two men and a team are employed to fill a large bin in the stable with pulverized clay, road-dust, or common soil. With this the floor of each stall is covered three inches deep, and on this layer is placed the litter, thus giving opportunity for a complete absorption of urine. This bin filled in one day with dried and pulverized earth sufficed for ten head of cattle during the stabling season. Dried clay was also used for the pig-pen and hen-roosts. To save manure from fire-fang it was covered with soil one inch deep. Water was occasionally applied to stop fermentation.

Huano manure.—A British inventor, Mr. Hughan, has brought forward a new fertilizer, termed Huano manure, which is formed by a combination of night-soil with phosphates. Sulphuric acid is used as in the manufacture of common superphosphate. The night-soil serves in the place of water to reduce the phosphates into the proper pasty condition for the action of the acid, which is then applied, and sulphate of lime or plaster of Paris is formed, and solidification and deodorization of the whole mass takes place.

Utilization of night-soil.—Mr. Lepmann, director of the Central Trial Station in Bavaria, estimates the annual value for fertilizing purposes of the human excrement annually wasted in the city of Munich, containing 177,600 inhabitants, at about $500,000. He states that Germany now possesses a system, called there the Tonnen or barrel system, by which he is confident that this enormous waste may be entirely prevented. The city of Gratz, containing 80,000 inhabitants, has this system in use in every house, and has thus demonstrated the practicability of using it in large cities. As an illustration of the profit to be derived from human excrement when fairly tested as a fertilizer, Mr. Lepmann refers to the fact that between the years 1850 and 1864 the price of that obtained from the barracks increased forty-five-fold.

Use of night-soil.—A farmer of Brunswick, Maine, lately stated that there was but one man in the town who had acquired wealth by farming alone, and that the latter had accomplished this by using large quantities of night-soil on his grass-land and cabbage-field.

Use of fertilizers in Connecticut.—In the vicinity of Westport, Southwestern Connecticut, on the shore of Long Island Sound, there were used fertilizers to the following amounts and value in 1871, per estimate of Mr. T. B. Wakeman, of that place: 60,000 bushels of ashes, at 25 cents

per bushel, $15,000; 500 tons of bones, at $35 per ton, $17,500; 120 tons of superphosphate, at $50 per ton, $6,000; 1,000 tons of salt hay, at $10 per ton, $10,000; 5,000 loads of sea-weed, at $1 per load, $5,000. Total, $53,500, all used by small farmers, and to a considerable extent for the onion-crop. As much manure is made on the farm as is possible, and fish-guano is little used. Onions are the principal crop, the yearly amount raised in the town ranging from 300,000 to 400,000 bushels, with an average of 500 bushels per acre. Price in 1871, 60 cents per bushel; before that, $2 per bushel on an average.

Commercial fertilizers in Germany.—An agricultural student at Berlin, writing at the close of 1871, says that in Germany fertilizers are sold at prices based on the proportions of their chemical constituents, and are warranted by the dealers to contain certain amounts of nitrogen, soluble phosphoric acid, &c. Buyers are able to test these representations by recourse to some one of the chemical laboratories which are established by government, or by private enterprise. Taking the average of eight standard German fertilizers and comparing them with averages of seven popular American fertilizers, chiefly superphosphates, it is found that the former contain 50 per cent. more nitrogen than the American fertilizers, and nearly three times as much soluble phosphoric acid, while in the American articles a given amount of fertilizing material costs 60 to 65 per cent. more than in the German, not taking into account the generally superior mechanical preparation of the latter. As regarding two elements of cost, capital can be had about as easily at 4 to 5 per cent. in Germany as at 6 or 7 per cent. in Connecticut and New York; but the difference in wages of labor is greater.

Imperfect pulverization.—The editor of the Southern Cultivator complains of the quality of the acid phosphates placed on the southern market. He states that the numerous samples which he had examined were made from Charleston phosphate so coarsely ground that the sulphuric acid applied had not been able to permeate the material. The consequence was that only a very small proportion of the "fertilizer" had been brought into a soluble condition.

Regulating sales of fertilizers.—The legislature of New Hampshire has passed a law regulating the sales of fertilizers, requiring that all packages be accompanied by certificates giving date of manufacture and percentages of ammonia and other constituents. In case of false certification a fine of $500 is imposed, and for sale without license, a fine of $200.

Chemical analysis of fertilizers.—At a recent meeting of the Queen's County (Ireland) Agricultural Society, Dr. Cameron stated that he had been consulting chemist to the society for the last nine years, during which time there had been a great change for the better in the character of fertilizers sold, and this change was justly attributable to the efforts of the society. The mischief which might result from a want of such organized watchfulness over the trade in fertilizers was exampled in the west of Ireland in 1871, where whole districts were laid waste, owing to the farmers having been misled into buying spurious guano at £15 to £17 per ton, which was not worth more than £4 per ton. In hundreds of cases the potatoes grown on this stuff did not reach the size of gooseberries, and the turnips sown with it grew no larger than apples.

Chemical manures in Great Britain.—It is estimated that about 500,000 tons of chemical manures are annually produced in the United Kingdom of Great Britain.

Bone-mills established by co-operation.—In England many of the large farmers take part in the establishment of bone-mills, whither they send

their purchased bones to be ground, thus securing an unadulterated bone-flour.

The guano supply.—Dr. Voelcker reports to the English Royal Agricultural Society that the supply of guano of good quality from the Peruvian islands will probably be abundant for many years.

Sea-weed as a fertilizer.—Professor S. W. Johnson, in presenting several analyses of sea-weed made in the laboratory of the Sheffield Scientific School, shows that a fertilizer formed of dried and pulverized sea-weed and fish-guano, in the proportion of 1,970 pounds of the former to 30 pounds of the latter nearly resembles stable-manure in composition, but is much more concentrated, so that one ton of the mixture is nearly equivalent to five tons of stable-manure. Mr. George E. Waring, of Newport, Rhode Island, states that the farmers of his neighborhood pay $4 to $4.50 per ton for sea-weed and haul it four or five miles. Large quantities of rock-weed are sold in New London and Stonington, Connecticut, and intermediate places for the same prices.

It should be remembered, however, that sea-weed which has been long subjected to the washing of the waves, or to exposure to the sun in small quantities, is worth comparatively little as a fertilizer.

Applications of burned clay.—Mr. Mechi has found burned subsoil an excellent and profitable application on cold tenacious clays containing very little calcareous matter. When he took his farm he burned thousands of loads, putting 80 loads per acre on some fields, and the effect of the application is still shown after the lapse of twenty-eight years. But it is his practice to repeat the dressing after a certain number of years. The clay should be well dried before burning, and when the heap has been made red-hot it will continue to burn the earth which is gradually added to it. The alkalies are set free by this burning and are made available for crops, especially roots, and the calcined material, worked into the soil, brings it into a comparatively friable condition. The method may be considered as a short way of attaining a condition of soil ordinarily reached by long cultivation. This dressing costs him about one shilling per ton, applied.

Fish oil and guano.—New York papers of August, 1872, stated that, during the two weeks ending the 17th of the month, the waters of Long Island swarmed with menhaden. One fishing company took 1,300,000, realizing $1 per thousand; another took 3,000,000. One company had rendered 5,000,000 into oil and guano during the season, not running to its full capacity. The price of the fish, formerly 60 cents per hundred, had been reduced to $1 per thousand; yet the fishermen asserted that they could make money at the latter rate if they could sell their whole catch. But only about one-third had been taken by the factories.

Potash in corn-cobs.—Dr. Herbert Hazard says there are 7.62 parts of carbonate of potash in 1,000 parts of corn-cobs.

Cotton-seed on sugar-land.—Mr. G. G. Zenor, a planter near Pattersonville, Louisiana, last year made 65 hogsheads of sugar from 35 acres of old prairie-land, of which 12 acres, fertilized with cotton-seed at a cost of $15 per acre, produced 35 hogsheads, or nearly 3 hogsheads per acre, the remaining part of the field producing less than 1⅓ hogsheads per acre. Thus the surplus product of 1⅔ hogsheads, or 2,000 pounds, per acre involves an additional cost for fertilizers of about three-quarters of a cent per pound.

Loss of ammonia by exposure.—In a recent experiment hen-manure allowed to dry slowly in the air lost in one month five-sixths of its ammonia, indicating the value of applications of gypsum or other preven-

tives of waste, and the difference which is likely to exist between the fresh and the commercial article.

Nitrate of soda and salt.—Mr. Mechi says that when a farmer obtains a profitable increase from the use of nitrate of soda or from salt, another, hearing of his success, makes a like application, and perhaps meets with an unfavorable result. Why? Because the conditions of soil were different. In the first case there might have been phosphate of lime lying inert in the soil which the soda reached and rendered soluble for plant-food; in the other case there might not have existed any appreciable amount of such inert material. The example thus presented by Mr. Mechi illustrates the lesson that no dependence should be placed on applications of special fertilizers unless some knowledge has been obtained by preliminary experiment or investigation concerning the relative constitution of the particular soil.

FARM MANAGEMENT.

Old ways and new ways in Missouri.—"J. P.," now a farmer at Pleasant Hill, Cass County, Missouri, states that the best part of his life was spent in the ship-yards of New York City, which he left only about five years ago. Notwithstanding his inexperience in farming, he has met with a fair success, to which the information derived from agricultural publications had contributed in no small degree. One of his neighbors said that he did not understand how it was that a man from the ship-yards could beat old farmers at their own business. Another declared that he believed that Mr. P. raised more on 120 acres than he himself did on 400. These men are old settlers, practice shallow plowing, and think that manure counts for nothing in that region. Mr. P.'s experience has proved to him the value of deep plowing and manuring, though Cass County is one of the best in Missouri in respect to fertility of soil.

Large farming in Connecticut.—C. C. and F. W. Goodrich, of Portland, Connecticut, cultivate 75 acres of land, applying 16 cords of manure per acre. They have contracted for five years for the manure of a quarry company whose works lie one mile from their farm, and they keep two teams drawing manure in the winter, and one team in the summer. They use phosphate to the value of $200 annually, buy their grain by the cargo, and grind it in their steam-mill. They feed about 200 pounds of meal per day. In 1871 they raised on 15 acres 16 tons of tobacco, which they sold in New York at prices ranging from 10 to 35 cents per pound. They raised and sold 3,000 pounds of turnip-seed and one ton of onion-seed, which last brought $1 per pound. They also grew 28,000 bushels of onions, for which they received $1.75 to $2 per barrel.

Farming in Texas.—Dr. D. W. Brodnax, of Cameron, Milam County, Texas, writes that Mr. John Gratham, of that neighborhood, with the assistance of an infirm boy, seventeen years of age, cultivated and raised, in 1868, 22 acres of cotton, from which he gathered 27 bales averaging 514 pounds, equal to 28$\frac{3}{5}$ bales averaging 500 pounds. On other land, with same labor, he made 1,000 bushels of corn. In 1869, on the same land, he made 20 bales of cotton, averaging 522 pounds per bale, and 800 bushels of corn. In 1870, on the same land and with the same labor, he raised 24 bales, averaging 518 pounds per bale, and 1,200 bushels of corn. His wife and two little daughters assisted in gathering and saving the crops. In addition, he raised potatoes, onions, and all the garden-vegetables usually cultivated here, largely in excess of the wants of his family. He also raised a number of hogs, and had a considerable quantity of bacon to sell. He paid $3 per acre for his land,

Gardening in California.—An Amador County (California) paper states that on Jackson Creek, in that county, there are four acres which have been under tillage for the last twenty years, and which are now owned and worked by six men and cultivated in vegetables, grapes, and fruit. The following is a statement of annual products: 375 loads of vegetables for the county markets, averaging $15 in value per load, $5,625; 800 gallons of wine, sold on the premises at an average of 75 cents per gallon, $600; total sales, $6,225, or $1,556.25 per acre, besides vegetables, fruit, and wine for ten persons, and the feed of three cows and four horses.

LIVE STOCK AND MEAT.

Cattle transportation.—The New York Times, in an article on the meat-markets of that city, says that the evils attendant on cattle transportation are still severely felt. Cattle continue to be transported in crowded and badly-constructed cars, and, as a consequence, cannot be fed or watered without much loss of time. Suffering from thirst and hunger as they are carried over the route, they become restive, and before reaching the journey's end many of them are so badly bruised that when they are slaughtered large portions of the meat are unfit for use. The improved trucks which were temporarily used on one or two lines of road have been set aside, because they could not be as quickly loaded or unloaded, nor be packed with as large a number of animals as could the common cattle-cars.

Cattle transportation in Austria.—The Austrian government has enforced the use, on all the railways of that empire, of an improved cattle-truck, arranged substantially on the Reid plan, and suitable for feeding and watering during transportation.

Heavy purchases of stock.—The purchases of one shipper at the Union Stock Yards of Chicago, in 1871, amounted to $10,000,000.

Short-horns and Ayrshires in Minnesota.—The first annual sale of the Lyndale herd of Colonel William S. King, near Minneapolis, Minnesota, took place June 19, 1872. Twenty-eight short-horn cows and heifers were sold at an average of $614; 12 short-horn bulls at an average of $450; 16 Ayrshire cows and heifers at an average of $124, and 7 Ayrshire bull-calves at an average of $66; total sales, $25,045. Parties from Minnesota, Iowa, and Illinois were the purchasers—the Glen Flora Stock-Breeding Association of Waukegan, Illinois, being the largest buyer, and taking nearly half of the short-horns, including 3 cows, at $1,700, $1,500, and $1,000. One of the bulls purchased by the association was resold to the agent of the Iowa Agricultural College for $1,000.

Sale of short-horns in England.—At the auction sale of Messrs. Harward & Downing's herd of short-horns at Winterford, Kidderminster, England, September 18, 1872, 52 cows and heifers and 9 bulls were sold for £15,458; the cows and heifers averaging a little over £237, and the bulls about £346. One of the bulls brought 1,650 guineas.

Rearing mules in Kentucky.—Mr. S. H. Elliott, of Edgar County, Kentucky, made a change in his stock in 1865 and turned his attention to rearing mules. At the close of 1871 he was feeding 150. He gives the following statement of average expense and profit per mule: cost of mule at weaning, $50; cost of keeping for 18 months, $20; total expense, $70; market-value at end of this period, $150; profit, $80.

Angora goats in California.—A San José (California) journal states that Butterfield & Son, on the San Benito, eighteen miles beyond Hol-

lister, have 120 thorough-bred Angora goats and 2,000 grades from one-half to sixty-three-sixty-fourths of pure blood. The fleeces of the grades were sold in New York, last year, at an average of 80 cents per pound. The writer judges that there must be quite 25,000 Angora grades in the State ranging from one-half blood to very nearly pure.

Angora goats in Utah.—A co-operative company formed through the efforts of J. E. Johnson, editor of the Utah Pomologist, having arranged for the importation of 130 Angora and Thibet goats for crossing with the common goat, succeeded in obtaining 108, which arrived in good condition. A portion of the shipment was lost in a severe storm on the Union Pacific Railroad.

Value of improved blood.—Mr. H. McCoughtry, of Winthrop, Iowa, writing in the early part of the present year, stated that in April, 1871, he procured from a breeder in New York an Essex boar six months old at a price of $50. The express charges amounted to $19.40, making the total cost $69.40. The cost of the animal becoming known among Mr. McCoughtry's neighbors excited much mirth at his expense. But a few months afterward he obtained $50 for five pigs got from a grade Essex sow by the boar, and in the fall and winter received $50 for the services of the latter.

Foot and mouth disease in England.—English official reports show 691,565 animals attacked by foot and mouth disease in 1871.

Milk from diseased cows.—In respect to the milk of cows affected with foot and mouth disease, the report of the Massachusetts board of health for 1871 shows that human beings may contract the disease by the use of such milk; in such cases the affection is generally limited to a sore mouth, and in rare instances the latter is accompanied by eruptions on the body. But when the milk is used by invalids and growing children more serious consequences may result.

Canned meat in Texas.—The stock firm of Allen, Poole & Co., in Southern Texas, employs about 1,000 men, owns over 200,000 head of cattle, brands 50,000 calves annually, and sells annually in the New Orleans market 24,000 calves, at prices ranging from $5 to $8 net, these sales including proceeds of animals purchased from other herdsmen. The firm has lately taken up the business of canning beef roasted by a patented process. The rough meat, neck and shoulders, are rejected in canning, and each can contains three to eight pounds of beef, generally in one piece. The juice is wholly retained, and the meat is said to be rich in flavor, though somewhat too much done to suit the tasteof many, and free from bone and gristle. It is sold by the quantity at about 14 cents per pound. The hides are shipped to New York, and average 13 cents per pound, or $5 to $6 per hide.

Australian canned meats.—The imports of Australian canned meats into the kingdom of Great Britain have risen from 91 cwt. in 1866, valued at £321, to 237,160 cwt., in 1871, valued at £513,186.

Exposing sales of bad meat.—The New York Tribune a few months ago published an article exposing the frauds practiced by a certain class of market-men on the people of that city, in the "fixing up" and vending of bad meat and poultry. The article included a list of offenders, with particulars of their offenses.

Refrigerating cars.—Refrigerating cars, for the transportation of fresh meat, butter, fruit, &c., are now run on most of the freight-trains from Chicago to New York. They are built with double walls filled in with charcoal, have a capacity for two tons of ice each, and can carry about 20,000 pounds of freight. They are so arranged that there is a constant circulation of cool dry air, and are examined at points on the road and ice supplied if necessary.

CEREALS.

Preservation of grain in vacuum.—The method proposed by Louvel, and favorably reported on by the French Academy of Sciences, is that of storing grain in large upright cylinders having openings above and below for admission and removal of material. The cylinder being filled, a vacuum of about 10 centimeters is produced by an air-pump, thus destroying insect life and drying any grain which may have been stored in a damp condition.

Preventing heating in grain-stacks.—A simple instrument has lately been devised, under the name of the hay-stack ventilator, for the purpose of ascertaining and counteracting the heating in the interior of stacks of hay or grain. It consists mainly of a wrought-iron tube, about 3 inches in diameter, long enough to reach into the middle of the stack, provided with a conical point at the tip, and pierced for about two-thirds its length with numerous holes. A screw arrangement is affixed to the posterior extremity, by which it can be connected with an accompanying discharge-pipe. For use this apparatus is to be driven horizontally into the stack to be investigated, either by means of a mallet or by a screw arrangement, and the temperature ascertained after a short interval by introducing a self-registering thermometer. Should the temperature be too high at any point in the stack, a tin tube is to be affixed vertically to the outer end of the iron tube, and an outward current of air from the interior of the stack produced, by means of which the heat is speedily carried off without any injury to the stack. Hooks may be attached to the tip of the instrument, by which small samples of the central part of the stack can be brought out.

A large wheat-field.—A farmer named Mitchell, in the San Joaquin Valley, California, had 36,000 acres in wheat early in March of the present year, and expected to increase the area to over 40,000 acres by the middle of that month.

A California wheat-crop.—The Haywood (California) Advocate states that Mr. John Minges, near Grayson, would market from his ranch this season 4,000 tons of wheat.

Successive volunteer crops.—Mr. Benjamin Ely, of Buckeye Township, Yolo County, California, laid down 45 acres to wheat in 1865, and afterward harvested five successive crops without sowing, plowing, or harrowing after the first season; but hogs were turned in on the stubble ground. The field averaged 35 bushels per acre yearly for the five years, and on the sixth year produced a good crop of hay.

FRUIT.

Fruit shipments of Southern Illinois.—The Centralia (Illinois) Sentinel of August 15, 1872, reported the following shipments from that point during the preceding week: By express, 40,000 pounds of peaches, and 290 pounds of grapes; by freight, 6,025 pounds of grapes, 10,980 pounds of apples, 1,120 pounds of pears, and 998,250 pounds of peaches. Total, 1,056,665 pounds; or 528$\frac{1}{3}$ tons. Producers realized but little over expenses of gathering, boxing, freight, and commission.

Delaware strawberry shipments.—According to official statements, the first considerable shipment in 1872 of strawberries from the Delaware Peninsula (Delaware and the eastern shore of Maryland) was on May 23, three car-loads, and the shipments gradually increased up to 51 car-loads, forwarded June 3. The season virtually closed on June 17, by which time 434 car-loads had passed north over the Delaware Railroad,

making, at the usual rate of 250 bushels per car, 108,500 bushels, giving to growers an estimated average return of 8 cents per quart. The conditions of the season were such that the Delaware crop had little advantage in arrival over that of New Jersey and Pennsylvania, and prices were therefore low. Only 27 car-loads were shipped from Delaware in 1870, and 219 in 1871.

Peaches in the Delaware Peninsula.—The Tribune, of Wilmington, Delaware, states the peach-crop of the Delaware Peninsula, in 1872, as follows: Shipments by rail, 1,970,400 baskets; by water to Baltimore and Philadelphia, 1,437,368 baskets; taken up by canners, 73,282 baskets; estimated amount absorbed by home consumption and distillation into brandy, 118,950 baskets; total, 3,600,000 baskets. At an average of 40 cents per basket, clear of freight and commission, the net returns to growers would reach $1,440,000.

A Maryland peach-farm.—Mr. Edward Wilkins, of Chestertown, Maryland, is stated to have 136,000 peach-trees on 1,350 acres. The peaches are packed in crates, each containing two baskets, and are sent to Baltimore by his own steamboat, and delivered at a canning-factory which contracts for his whole crop.

Pear-culture in Vermont—In a paper read before the Vermont board of agriculture in February, 1872, Mr. Henry Lane indorsed the estimate that not 5 per cent. of all the pear-trees sold by nurserymen and planted in that State lived to the age of ten years, adding that, in his opinion, setting aside the Lake Champlain region, not 2 per cent. of the pear-trees planted in the rest of the State during the last twenty-five years had arrived to a profitable maturity. A very great proportion of the failures had been caused by improper selection—taking trees from milder climates and those which had been unduly stimulated in the nursery.

The banana-trade.—The Boston Cultivator estimates the amount of bananas usually received at that port during the season at 8 cargoes, worth at the wharf $6,000 to $7,000 each, making, with 50 cargoes received at New York, a total of about $375,000 as the value of receipts at New York and Boston. The banana season begins in March or April and extends into August. Baracoa, on the north coast of Cuba, is a favorite shipping port; shipments are also made from Aspinwall and the Spanish Main.

Shipments of California fruit.—The Boston Commercial Bulletin of January 6, 1872, reported the arrival during that week of the first shipment of pears ever made direct from California to that city. The shipment consisted of 400 boxes, of 3 pecks each, forwarded by rail from Sacramento, and was received in excellent condition. The freight-bill amounted to $700, averaging $2.33⅓ per bushel.

The Pacific Rural Press, of September 28, 1872, says that one firm in Sacramento had already, during the season, shipped 13 car-loads of Bartlett pears by rail overland.

Oranges in Southern California.—California papers state the orange-crop of Los Angeles County for the season of 1871–'72 at five millions, nearly five times the amount of the preceding crop; average price $20 per thousand. Lots of low quality sold at $7, and some extra fine brought $35 per thousand.

Fluctuations in the California grape-crop.—General Henry M. Naglee, of San José, California, an experienced viniculturist, says that, as a rule, in two years out of five, the grape-crop of the State is comparatively a failure.

Dried fruit in North Carolina.—The annual value of the dried fruit

sent from High Point, North Carolina, is stated at between $300,000 and $400,000. Every family in the surrounding region has its orchard and drying-house; the latter frequently rudely built of logs, with a flue running through it.

The Alden fruit-drying process.—The Alden process, which is briefly characterized as a method of evaporating the moisture of the fruit by conveying the latter gradually through a hot-air chamber, on frames attached to an endless vertical chain, is being introduced largely in fruit-growing regions. The peculiar value of the process lies in the remarkable retention of the original flavor of the fruit, and the perfectly clean and bright condition of the dried article. Large amounts of the Alden preparations are taken up by the United States Government for Army and Navy use.

A committee of the New York Farmers' Club, which recently visited an Alden factory at Neshanie, New Jersey, reports as follows concerning a small evaporator, capable of working 300 bushels of apples per week: Price of the evaporator, $1,000; cost of building, &c., $1,000. Total investment, $2,000. Running expenses per week: 300 bushels of apples, at 30 cents per bushel, $90; wages of one man, $12; of eight girls, $40; one-half ton of coal, $7; interest, $10; contingencies of factory, $7.95; a liberal allowance for cost of barrels, freight, and miscellaneous incidentals, $25.05. Total weekly expenses, $192. Receipts per week: 2,000 pounds evaporated apples, at 15 cents per pound, $300; 700 pounds dried cores and skins, at 6 cents per pound, $42. Total, $342, showing a net profit, per week, of fully $150. The cores and skins are sold to a company which manufactures them into jelly.

Cranberries in Wisconsin.—In the neighborhood of Berlin, Wisconsin, there are large tracts of marsh-lands in which the cranberry is indigenous. There were about 2,400 acres under improvement in 1871, the improvements consisting of ditches, flood-gates, and dams, for drainage and flowing, no further culture being given. Among the largest growers are Messrs. H. S. Sacket and James Carey. Mr. Sacket had 520 acres of marsh under culture in 1871, which produced 4,100 barrels, or 12,300 bushels of cranberries; these were marketed at $56,000, or an average of about $14 per barrel. His berries are wholly of the Bell and Bugle varieties, receive extra care, are of superior size, and bring the highest prices. Mr. Carey had 200 acres in bearing which produced 5,000 barrels. Mr. Sacket reports the shipments of cranberries from Berlin in 1871 at 18,000 barrels. He adds that there are cranberry marsh-lands in that vicinity purchasable, unimproved, at $10 to $20 per acre, which, after being handled for three or four years, would net $500 to $1,000 per acre. Generally speaking, the berries can be placed in Chicago at an expense of $5 per barrel, including cost of growing, picking, and marketing.

The Western Farmer reports that 25,000 barrels of cranberries were grown in the vicinity of Berlin in 1872.

TIMBER AND TREE CULTURE.

Timber in California.—The Report of the California State Agricultural Society for 1870–'71 says that, according to careful estimates, one-third of the wood and timber existing in California twenty-two years ago has been consumed. The requirements of the State for forest products will be at least ten times greater for the next twenty-two years. The scarcity of hard-wood timber is particularly injurious by restraining the manufacture and enhancing the prices of agricultural machinery and

vehicles. Recent experiments made by the State Agricultural Society have shown that, contrary to a prevalent impression, the climate is not unfavorable to the growth of hard-wood timber.

Tree culture in California.—The legislature of California recently passed an act to encourage the culture of forest and timber trees. It provides for three commissioners, who appoint a State forester at a salary of $175 per month. The forester is to collect, exchange, grow, and import seeds and seedlings of forest and timber trees and distribute them gratuitously, is authorized to expend $3,000 yearly for these purposes, and is to be assisted in the distribution by the county supervisors. He is also authorized to expend $3,000 the first year, and afterward $2,000 annually, in establishing and maintaining nurseries for rearing trees and acclimatizing foreign plants and trees, and from these nurseries shade-trees are to be furnished for grounds belonging to the State and its counties and cities. The forester is also to diffuse information respecting tree-culture.

Large enterprise in tree-planting.—It is announced that Mr. S. T. Kelsey has contracted with the Atchison, Topeka, and Santa Fé Railroad to plant a quarter-section in trees every ten miles along the line of the road from Atchison to the western line of the State, a distance of about three hundred miles. He is allowed eight years in which to complete the work, is to provide the stock, plant and maintain the trees, and is to receive from the road a section of land at each point of planting, including the quarter-section in trees.

Pine-timber in Eastern Massachusetts.—Mr. W. D. Philbrick, of Middlesex County, Massachusetts, says that twenty-five years ago, within his recollection, the best clear white pine sold there for $15 per thousand; now it is difficult to find as good a quality at $80 per thousand.

Destruction of forests in the Northwest.—Mr. Jonathan Periam, of Chicago, estimates that 330,000 acres are annually denuded of timber in Northern Michigan and Wisconsin, and Mr. Arthur Bryant estimates the annual area of destruction in the same district with Minnesota joined at 600,000 acres.

European larch.—Professor James Mathews, of the Iowa Agricultural College, who has grown the European larch in Iowa for seventeen years, is led by his experience to doubt the durability of its wood when grown on rich western soils. Authorities indicate a certain coldness of climate and poverty of soil as necessary to the production of this timber in perfection.

POULTRY AND EGGS.

Raising poultry in Iowa.—Mrs. D. W. Gage, near Ames, Iowa, raised in 1871 600 chickens, of which about 150 were Brahmas and Houdans, the rest being half-blood. One Brahma cock, nine months old, weighed $11\frac{3}{4}$ pounds. The poultry brought at Ames 6 cents per pound, live weight, while pork brought $3.20 per hundred. Mrs. Gage states that she can raise poultry as cheaply as she can pork, weight for weight, and generally sell for twice as much. As to her method of rearing, for three or four days after hatching, the chickens were fed with hard-boiled eggs and cheese-curd, after which they received mush made from corn-meal and wheat. Mrs. Gage recommends willows planted close as a shelter for fowls; the leaves also afford them an agreeable food. She finds the Brahmas profitable for market, but for the home-table prefers Houdans.

Aylesbury ducks.—A London journal states that a very large trade is carried on in Aylesbury and its neighborhood in furnishing young ducks

for the London market. Supplies are forwarded by rail, twice a week, the shipment from Aylesbury often reaching several tons. More than £20,000 per year are returned to the neighborhood for these fowls. In January, 1872, the eggs brought 8 shillings per dozen. The ducks are chiefly raised by cottagers, who make a good living, and it is not unusual to find 2,000 to 3,000 young ducks in one cottage or its adjoining premises. The great point of the business lies in forcing the fowls rapidly and skillfully. After the first week in November they are forced on with stimulating food, barley-meal, tallow-greaves, whole barley, &c. Soon after Christmas they begin to lay. The eggs are placed under hens, and when they are hatched one hen takes charge of three or four broods. A large proportion of the ducklings die. They are fed on boiled eggs, chopped fine and sprinkled with a little meal, and afterward boiled bullock's liver, cut fine, is mixed with the food. But little water is allowed. After the ducks are about three weeks old they receive barley-meal, tallow-greaves, &c., and in six or seven weeks are fit for market, weighing 2 pounds to 3 pounds each.

Statistics of egg consumption.—The American Poultry Gazette reports 414,034 barrels of eggs received in New York City during 1871, containing 25,912,210 dozen, worth $5,661,973.85. This account does not include small packages and eggs brought in by marketmen and others living near the city, which, it is estimated, would swell the value to over $8,000,000.

The Chicago Times, a few months ago, gave a detailed statement of the receipts of fifty-seven dealers in that city, for the year ending July 31, 1871, amounting to 4,662,500 dozen; estimated receipts of other dealers, 4,000,000 dozen; making a total for the year of 8,662,500 dozen.

CORN-FODDER.

Corn-fodder.—Mr. R. H. Simmons writes the Germantown (Pennsylvania) Telegraph that, on June 3, he drilled 12 quarts of corn in rows 2 feet apart on one-third of an acre of mucky land, manured with 1½ cords of fine manure. He cultivated twice, taking one-half hour each time, his man following him with a hand-hoe; total time in cultivating and hoeing, three hours. The corn grew 10 feet high, and was cut up just as the tassels began to blossom; it made 300 bundles, averaging 20 pounds green and 8 pounds dry, being at the rate of 7,200 pounds of dry fodder per acre. This dried fodder, he judged from his own experience, to be worth more for feeding to milch-cows than the best hay, ton for ton. His cows ate it perfectly clean, and gave a large flow of milk while kept upon it.

"B. K.," of Peekskill, New York, states that in the last part of June, 1871, he cut three tons of hay from 2¼ acres, and early in July plowed this area 7 or 8 inches, harrowed smooth, and drilled mixed western corn in rows 4 feet apart, sowing 2 bushels per acre, covered the drills with fresh cow-manure, laying the latter 1 foot wide and 3 inches deep, and covered this dressing lightly with earth. The cultivator was run through the corn four times up to August 10, and no hoeing was given. September 10, he cut the corn with a sickle, laying it crosswise with the rows, and let it remain for five days, then tied in bundles and stooked on adjoining grass-land. The corn-field was immediately replowed, smoothed, and seeded to timothy. The corn stood in stook for two months, when, being well cured, it was housed. The stalks were tall and slender and the corn was eaten clean, without machine-cutting, fur-

nishing one meal per day for all his cattle up to the middle of April, 1872. There were 8 tons of the corn-fodder, making, with the hay, 11 tons of forage from 2¼ acres.

MISCELLANEOUS.

Steam culture in Europe.—In Great Britain there are single establishments for manufacturing steam-plows so extensive that they employ constantly not less than 1,200 men. In England between 400 and 500 sets of steam-plows are held by companies and by individual owners for hire, and give good profits to the proprietors. In Scotland joint-stock companies are investing in land and steam-machinery and securing large dividends; and in Germany, also, steam-power is working a revolution in agriculture.

British agricultural returns.—In illustration of the value of the agricultural returns now annually collected in Great Britain, English journals reproduce the estimate of Mr. Caird, based on these returns and published in the London Times of September, 1871, and show its correspondence with the actual result. According to the estimate, with a late harvest, an import of 11,000,000 quarters of wheat would suffice for the wants of Great Britain for the present year, but with the expected early harvest, 10,000,000 quarters would be sufficient. The imports for the year up to August 1 were about 10,000,000 quarters.

The agricultural returns of Great Britain for 1872 give the following particulars: Wheat, 3,599,158 acres, showing an increase of .8 per cent. over the wheat acreage of 1871, and 2.8 per cent. over that of 1870. Barley, 2,316,235 acres, showing a decrease of 2.9 per cent. from the acreage of 1871, and 2.3 per cent. from that of 1870. Oats, 2,705,645 acres, showing a decrease of .3 per cent. from the acreage of 1871, and 2.1 per cent. from that of 1870. Potatoes, 564,083 acres, showing a decrease of 10.1 per cent. from the acreage of 1871, and 4 per cent. from that of 1870. Hops, 61,929 acres, showing an increase of .3 per cent. over the acreage of 1871, and .2 per cent. over that of 1870. On the 25th of June, 1872, there were in Great Britain 5,624,106 cattle, 27,922,864 sheep, and 2,784,890 pigs. In the number of cattle there was an increase of 5.3 per cent. over that of 1871, and 4.1 per cent. over that of 1870; in the number of sheep an increase of 2.9 per cent. over that of 1871, and a decrease of 1.7 per cent. from that of 1870; in the number of pigs, an increase of 11.4 per cent. over that of 1871, and 28.3 per cent. over that of 1870.

Agricultural progress in Scotland.—A few months ago, in an address before the Haddingtonshire Association, Scotland, Mr. George Hope, illustrating the advance which had been made in agriculture within his own recollection, said that he had seen the county thoroughly tile-drained, and the farmers enabled to dispense with plain fallows, substituting large crops of potatoes and turnips. The product of the grain-crops had increased 50 per cent., and in many cases had doubled, while the number of sheep and cattle fed and marketed had increased 200 per cent. A few years ago, scarce a penny was outlaid for manures and feeding stuffs, but now the annual outlay for these equaled the rental of the whole county. At the time of his speaking there were eight steam-plows in the county.

The secret of a prosperous agriculture.—Mr. Mechi, the well-known English agriculturist, says that it is precisely because British farmers have their customers, the British manufacturers, almost at their doors, while

other corn-producing countries have not the like advantages, that British agriculture is rich and thriving.

Farmers' protective association.—Four farmers' clubs in Southwestern New Jersey, namely, the Progressive Farmers' Club, of Mount Laurel; the Farmers' Club of Woodbury; the Farmers' Mutual Benefit Association of Camden County; and the Burlington County Farmers' Club, at Mount Holly, have associated themselves together under the name of the Farmers' Conference Club of New Jersey, and have engaged a prominent member of the Philadelphia bar as a permanent counsel for the advice and assistance of members. This action has been taken on account of grievances heretofore suffered by farmers dealing with the city markets.

Association of producers.—The Sidney Farmers' Association of Champaign County, Illinois, contracts, on behalf of its members, for sales and purchases in quantity. For example, in a membership of 100 there are 1,000 hogs to be disposed of; a committee is appointed who arrange for their sale, securing a small advance over current prices, on account of the size of the lot. In selling grain, the general shipper of the association returns the value of the grain in the Toledo, New York, or Boston market, (as the case may be,) after deducting charges of transportation, and a commission of one-half cent per bushel.

Agricultural organization in California.—Much interest has been aroused in California in respect to agricultural organization for business purposes, and a State Farmers' Union has been projected, including in its scheme local clubs with representation in the central society. The co-operative principle has been carried into effect with much advantage in several town and county associations of farmers in that State. At a meeting of the Stanislaus Farmers' Club, at La Grange, December 8, 1872, Mr. W. J. Warder said that in an interview with Mr. Ten Basch, of San Francisco, that gentlemen had offered to ship wheat for associated farmers at the lowest market-prices, to advance $20 per ton while afloat, without interest, to make no charge for drayage or storage, and to charge commission only for sales in Liverpool. If the wheat was to be stored for a rise, it would be held at a rate of 4 per cent. per annum. It was stated that the Oakland club by combining had obtained their sacks that season at 11 cents apiece, instead of 18 to 20 cents apiece, the current price, and that parties had offered to the club, on grain in store, an advance of 70 per cent. at 6 and 7 per cent. interest, yearly. At the Sonoma Farmers' Club allusion was made to the successful operation of combinations of farmers in Iowa and Illinois, owning warehouses, employing shipping agents, and forwarding products by the car-load and cargo under special contracts with railroads, mercantile men, and consumers.

Corn for fuel.—D. H. Wheeler, secretary of the Nebraska State board of agriculture, reports that during the winter of 1871-'72 many families in all parts of the State used corn for fuel, finding it cheaper, considering its low price in the market, than coal at $9 per ton. It is claimed that 50 to 100 bushels of corn per acre are a common yield, and that the cost of raising is 8 to 11 cents per bushel. The corn makes a good fire, but requires constant attention.

Potato-starch factories.—Mr. Moses Woodward, of Jefferson, Coos County, New Hampshire, an experienced starch manufacturer, states that in his section a good potato-starch mill capable of turning out nine tons of starch per week would cost about $3,800, not including power for engine or mill-dam. As much power would be required as for a common wool-carding machine, and three men would be needed to work the

factory. The process of manufacture is comparatively simple, and any ordinary man could learn it in three months. Common potatoes usually yield 8 pounds of starch per bushel; good table-potatoes, 9 pounds, and it takes about one-half of a cord of wood to dry one ton of starch.

An expert in Hinsdale, New Hampshire, says that the manufacture of potato-starch cannot be made profitable where more than 25 cents per bushel are paid for the potatoes. Another statement, from Northeastern Vermont, shows that in the fall of 1871 the factories in that region paid 25 cents per bushel for potatoes. A writer in Malone, Franklin County, New York, reports that within a radius of ten miles from that village there are 20 starch-factories, that these cost from $4,000 to $6,000 each, and work up 4,000 to 12,000 bushels of potatoes each in a season, their daily capacity ranging from 300 to 400 bushels. A bushel of potatoes yields 9 to 10½ pounds of starch.

The Manchester Mirror reports the names of sixty-five potato-starch factories in Northern New Hampshire, nearly all of them being in the counties of Coos and Grafton. In 1871 these factories made 3,060½ tons of starch. Levi Bartlett, referring to his visit to that region and the profits obtained by its farmers in growing potatoes for starch, says that a large proportion of the lands are new, recently cleared from forests. He indicates the danger arising from the exhaustive nature of the crop, and the probability that serious prospective injury might be averted by returning to the soil the potato pomace remaining after the separation of the starch, with the plant-tops, thus restoring most of the mineral elements—potash, phosphoric acid, &c.—abstracted from the soil.

Agricultural machinery in Oregon.—The Willamette Farmer states that the sales of agricultural machinery in Portland, Oregon, during May, 1872, amounted to $300,000, sales by one house reaching $176,000. According to estimate, about one million dollars' worth of agricultural machinery has been sold in Oregon during the season, 75 per cent. of the purchase-money going out of the State to meet manufacturers' charges and freight.

Inducements to immigrants—Mrs. Calton Belt, of Locopolis, Mississippi, in view of proposed immigration from Alsace, offers homes for sixty farmers and their families, and engages to make loans to such as have not means to commence operations. Fifty acres are to be set apart for each cottage; 15 acres to be rent free for the family sustenance, the rest to be cultivated in cotton, of which the lessor shall receive one-half. Homes are also offered to a manufacturing colony.

An immigrant's success.—The following points are from an account given in the London Agricultural Gazette: In 1855 Charles Butcher and son arrived from England in Monroe County, New York, where they obtained work at $16 per month, each. Commencing penniless, they accumulated in three years between $500 and $600. They then bought a farm of 64 acres at $50 an acre, paying $500 in cash. The farm was subject to overflow and the ravages of wire-worms, but the new owners renovated it by skillful labor. The son married. In five years the farm was paid for and stocked, and after about two years more was sold for $85 per acre. A better farm of 140 acres was purchased at $95 per acre, which is now paid for, and the whole property is now valued at over $15,000. Lately, the father, at the age of fifty-eight years, has sold his interest to the son for $10,000, payable in twelve years, at 7 per cent. interest.

Disproportionate premiums.—Mr. C. T. Leonard, of Ohio, reports that a certain agricultural society in that State, at its first annual fair in 1866, offered premiums on horses to the amount of $210, of which only $6

was for farm-horses, while the premiums on wheat and corn amounted to $7.50 only, and on cheese to $13. He adds that the premium-lists of the society in later years have shown a similar disproportion. In the autumn of 1871 he visited the fair of an agricultural society whose officers had cut down the premiums on fast horses. When the time arrived for the exhibition of this class those who had entered horses rode into the ring and insisted on the premiums being doubled in amount, and their demands were complied with.

Experimental stations.—The system of agricultural experimental stations is rapidly extending in Italy. In consequence of information obtained and circulated by the minister of agriculture, respecting the experimental stations in Germany, seven new stations have been established on the German model. These are located at Udine, Modena, Milan, Lodi, Padua, Florence, and Turin.

Application of entomological science.—Professor S. I. Smith, in a recent address before the Connecticut board of agriculture, made the following statement: In 1866 an agricultural paper in Maryland published an editorial calling particular attention to a purported discovery for destroying the Hessian fly, the inventor offering to sell county-rights for using the preventive at $100 each. This "invention" was founded on the mistaken supposition that the Hessian fly deposits its eggs on the grain in the wheat-ear in midsummer. Professor Walsh thinks that this and other erroneous representations of the inventor may be explained on the ground that the latter mistook one of the parasites preying on the Hessian fly for that insect; in other words, the wheat-grower's friend for his deadly enemy.

In the debate following Professor Smith's address, Mr. J. S. Gould, of New York, remarked that the asparagus-beetle, so injurious in Great Britain and other parts of Europe, was unknown in this country until about eight years ago, when it swept down in clouds on the immense asparagus-beds of Long Island. Dr. Fitch, the entomologist, was sent for, and on his advice the hens were turned into the fields; the result has been that the insect now does little damage there. About the same time an orange-colored aphis, before unknown in this country, began to ravage wheat-crops in New York. In his own region, in 1864, the whole crop was destroyed by it. But soon a red bug appeared, preying on this aphis, and in the course of three years the latter disappeared. Farmers should learn to discriminate between their friends and foes among insects, and great losses have resulted from ignorance on this and kindred points.

Mississippi crop reports.—In February, 1872, the legislature of Mississippi passed an act providing for a system of crop reports in that State, under the supervision of the editor of the Field and Factory, an agricultural journal at Jackson. Three thousand dollars were appropriated to this purpose for the year.

A New Hampshire farmer.—At a late meeting of the New Hampshire board of agriculture at Gilmanton Iron Works, Colonel D. M. Clough said that in 1872 he kept 7 yoke of oxen, 105 cattle, 175 sheep, and 4 horses, raised 2,000 bushels of corn and 1,200 bushels of oats, and cut and fed 250 tons of fodder. Colonel Clough, who is now sixty-eight years of age, also sorted and placed in crib 1,800 bushels of corn.

Farming in Iowa.—James P. Coulter, of Johnson County, Iowa, raised last year 12,000 bushels of corn, 2,000 of oats, 500 of wheat, 900 of timothy-seed, and 600 of flax-seed; keeps 300 hogs, 40 cattle, 18 horses, and has 640 acres of prairie-land under cultivation.

Large plantation.—Colonel B. G. Lockett, near Albany, Georgia, had

this year 6,500 acres in cotton, and 3,500 acres in corn and small grain. Three hundred and sixty hands (colored) were employed, receiving wages, payable quarterly. Rations were also furnished.

Colorado flour for the East.—The Greeley Tribune, Colorado, in October, 1872, recorded the fact that an order had been received at Denver from Boston for 50 car-loads of flour.

Large yield of potatoes.—The Sac (Iowa) Sun says that Mr. D. B. Nelson, of that vicinity, raised, in 1871, on two acres, 700 bushels of potatoes, and on one acre 525 bushels.

Different soils for different varieties of potatoes.—Mr. C. H. Sweet, of Onondaga County, New York, says that several years of experience in buying and selling potatoes and experiment in growing them have proved to him that different varieties require different soils, if not different methods of culture, in order to the attainment of the best results. On chestnut loam, near Rochester, he has grown the Fluke and the Prince Albert, obtaining large yields of superior quality; but on the clay-loams of the section where he now resides, and with the same manures and culture as in the first-mentioned case, these varieties are inferior in yield and quality. In the northern part of the county, on sandy and limestone soils, the Early Goodrich does not succeed well, while in his locality it is the best in yield and quality of any of the varieties grown, not excepting the Early Rose.

Products of Southeastern Virginia.—The Norfolk Virginian states that 225,450 bushels of pea-nuts, worth about 500,000, were raised in the southeastern counties of the State in 1871. There were also exported about $2,500,000 worth of cotton, fruits, vegetables, &c., besides grain and lumber, value not stated.

Shipments of Missouri sumac.—In the early part of the current year 12,000 pounds of sumac were shipped from Missouri to New York by rail, and thence by vessel to Saint John's, New Brunswick, to be used for tanning purposes. This is stated to have been the first shipment of sumac from Missouri.

Onions in Massachusetts.—Mr. C. P. Warner, of Sunderland, Massachusetts, reports his average crop of onions at 500 bushels per acre. His most profitable season was in 1864, when prices reached $1.50 per bushel. In 1871 he obtained 600 bushels per acre; price 67 cents per bushel. The following is his estimate of the cost of the crop per acre: Preparation of ground, $10; manures and fertilizers, $100; seed, $15; cultivation, $100; rent of land, $30; total, $255. On the crop of 1871 this would show a profit of $147 per acre.

Tea-culture in California.—The attempts at tea-growing in California appear to have resulted in failure. The experiment in El Dorado County was superintended by a gentleman experienced in the tea-culture of Japan, but neither there nor at Calistoga did the plant exhibit a satisfactory growth. The Pacific Rural Press expresses the fear that the climate of the State is not adapted to tea-culture.

The Buena Vista vineyards.—The Buena Vista Viniculturist Association, of Sonoma County, California, in 1871, made 142,000 gallons of wine and 5,000 gallons of brandy. Five thousand bottles of champagne are turned out per month, and there were about 30,000 lying in the racks in July, 1872. The association has 540 acres of bearing vines.

Silk-raising in California.—The impetus given to the raising of silkworms in California was checked by the failure of the cocoon trade with Europe. The introduction of "family reels" for reeling the cocoons is not deemed desirable, manufacturers of silks preferring larger lots, carefully assorted, composed of threads which are uniform in size,

luster, and quality. It is now proposed to establish, at central locations in silk-raising districts, reeling factories, or "*ateliers de moulinage*," as they are called in France, where cocoons may be reeled "into grege, trams, and organzines." These will afford a market to which small producers can bring their cocoons, and at which they can be assorted and reeled in uniform threads of different grades, and in quantities to suit manufacturers.

Fish-culture in California.—The recent report of the president of the California Acclimatizing Society stated that the society had then in its possession 12,138 eastern trout, 500 Tahoe trout, 1,400 salmon-trout, 1,700 San Andreas trout, and 9 bass. During the year there had been constructed nine ponds, a dwelling-house for the workmen, a hatching-house, hatching-boxes, flumes, dams, &c.

Salmon on the Pacific coast.—Reports from the Columbia River fisheries, for the four months ending August 1, 1872, show 170,000 salmon canned, dressed weight 2,700,000 pounds, value $432,000; salmon taken for curing, 162,500, dressed weight 2,600,000 pounds, value $117,000.

Electrical treatment of wine.—It is stated that the quality of wines may be improved by passing through them an electrical current from platinum electrodes.

The spectroscope in testing wines.—Mr. J. C. Scoby, of England, has successfully applied the spectroscope for testing the purity of wine.

Artesian wells in Southern California.—The Los Angeles Star stated, in the early part of the current year, that there were then about one hundred artesian wells in that county, half of them running. One of the best was only 27 feet deep, two 29, and another 32 feet, and these were the shallowest artesian wells in the State. These, with a fifth of 92 feet, and a sixth of 135 feet in depth, are situated within a radius of four miles, and taken together throw up 1,000,000 gallons daily. Their average bore is 7 inches.

Clover in Georgia.—Mr. R. B. Baxter, of the Hancock County (Georgia) Agricultural Club, in September, 1871, on three-quarters of an acre of mulatto soil, carefully plowed and harrowed, sowed one peck of clean clover-seed. The first cutting was in January, and gave 3,840 pounds of fine fragrant hay. In April a barrel of plaster was applied broadcast just after a small shower of rain, and on August 12 a second cutting was made, estimated to have been equivalent to 2,000 pounds of hay, but this crop was nearly all spoiled by four days of continuous rain.

Clover-seed in Western New York.—A firm in Waterloo, New York, writing in May, 1872, stated that the amount of clover-seed shipped from that station during the season reached 1,330,857 pounds, making more than 66 car-loads. The amount forwarded from Geneva was estimated at about 233,000 pounds; from Seneca Falls, 145,000 pounds—total, 1,708,857 pounds, or over 854 tons. The entire crop of the section was about 30,000 bushels, and in many cases the yield had ranged as high as 5 bushels per acre. One grower obtained 315 bushels from 48 acres, averaging 6 bushels and 33 pounds per acre, and the crop sold for over $2,200. It was of the large variety and of extra quality.

Alfalfa on sage-brush land.—The Reno Crescent, of Reno, Nevada, reports 13½ tons of alfalfa seed sold in that town in the spring of 1872, against 3 tons sold in 1871. The same paper gives the names of twelve persons, who, in 1872, on 625 acres of sage-brush land, hitherto deemed worthless, raised 1,995 tons of alfalfa hay, in some cases reaching an average of 6 tons per acre. The much smaller general average here shown is partly from the fact that while some grow for hay alone, others graze for a portion of the season, and others devote part of the acreage

to seed. One gentleman reserved 40 acres for seed; estimated value of their product, $2,000. The hay crop of the valley had been increased fully 3,000 tons by the introduction of alfalfa, and there was an opportunity for a much greater addition. It is stated that the average yearly crop, three cuttings, after the third year from seeding, is fully five tons per acre. The alfalfa is found peculiarly adapted to a dry gravelly soil, and affords an excellent feed for purposes of milk as well as for beef.

Encouragement of beet-sugar manufacture.—In April, 1872, the legislature of New Jersey passed an act, operative for ten years, exempting beet-sugar factories from taxation.

Preparation of beet-leaves for fodder.—The method of Mehay consists in placing the beet-leaves in baskets and immersing them in a tank containing dilute hydrochloric acid of 4° Beaume, then removing and allowing to drain. The leaves, condensed in bulk by this treatment, are then bedded in dry earth until needed for use. This prepared food is said to be very palatable to stock, and, when given to milch-cows, to increase the quantity of milk and improve its butter quality.

A plant destructive to bees.—Mr. H. E. Norton, of Lehi City, Utah, observes that the large podded milk-weed almost invariably causes the death of every bee alighting upon it. The bee either adheres to the plant, or else bears away a small scale sticking to its feet, and cripples itself fatally in attempting to remove the annoyance.

The new curculio-catcher.—Dr. Hull's new curculio-catcher resembles in shape his wheel-barrow machine, already widely known. But the new machine, instead of being mounted on a wheelbarrow, is suspended from the shoulders of the operator, who stands in the center. A slit is left open in order that the machine may be pushed against and around the tree, and when this is done the aperture is closed by a strip of cotton and the tree is jarred by striking with a covered mallet. The machine weighs 8 to 10 pounds. Dr. Hull states that he has been able, with this invention, to go over 960 three-year-old trees in three and one-half hours, but in this case the rapidity of operation was facilitated by the trunks being clear of branches to a considerable height.

Flax and linseed oil in Oregon.—G. P. Holman, agent of the Pioneer Oil Company, Salem, Oregon, in a letter to the Department, in December, 1872, writes that the company's factory is the first and only one in Oregon manufacturing linseed-oil. The first linseed-oil manufactured was at date of December 25, 1867. The capacity of the mill is 180,000 gallons per annum, but only about 50,000 gallons are made yearly, owing to the restricted market afforded by the Pacific coast. The only other mill on the coast is at San Francisco. Sales in Oregon are increasing at the rate of about 8,000 gallons yearly; during 1872 shipments were made to the Hawaiian Islands, British Columbia, and Puget Sound. There being no manufactories in Oregon for utilizing the straw, the factory uses the Bombay, or large seed flax, which yields very little lint, and the supply of seed has been obtained chiefly from Linn County, at a price of 3 cents per pound. The oil-meal finds a ready sale for cattle-feed. The company expects to secure, in 1873, 5,000 acres of flax, grown under contract. Mr. Holman adds that his experience, as well as that of old flax-growers, shows that the Willamette Valley will produce flax-lint of the first quality, and that the introduction of factories for working the fiber will secure to the farmers a very remunerative business.

Sugar-lands in Florida.—Mr. R. W. B. Hodgson, of Levy County, Florida, writing in the early part of 1872, says that the county is specially remarkable for its rich and inexhaustible hammock-lands, rich loam, with clay subsoil, based on shell-lime, and marl, admirably adapted

to sugar. Illustrating the latter point he states that, during the preceding season, an unfavorable one to hammock-land, a small farmer obtained on one acre of new ground, without manure, 3,000 pounds of sugar, worth $300, and 140 gallons of molasses, worth $70. Another farmer, the same season, made 8,000 pounds of sugar on not quite five acres of manured pine-land, and two years ago parties made on the same land 2,400 pounds per acre, or nearly 12,000 pounds total. 1,500 pounds to 2,000 pounds is common on manured pine-lands. One man and a horse will cultivate about twenty acres in cane, the same area as in corn. The section is also excellent for oranges, peaches, figs, pomegranates, grapes, &c.

Ginseng in North Carolina.—Mr. J. D. Abbott, of Murphy, Cherokee County, North Carolina, writes that in 1871 there were three different parties engaged in purchasing ginseng in that county. Prices paid, 25 to 27 cents per pound, green and unwashed; amount purchased, from 75,000 to 85,000 pounds. This year's crop will be about as large.

Mesquite-gum.—Mr. F. Kalteyer, treasurer of the Agricultural and Industrial Association of Western Texas, says the mesquite-gum of that region is almost identical with gum arabic, having been in use there for medicinal and technical purposes, especially in the prepartion of mucilage, gum-drops, jujube-paste, &c. The past year it has become an article of export, some 12,000 pounds having been gathered in Bexar County, and as much more between that and the coast. This gum is hardly known east of the Brazos. It exudes from the stem and branches of a *Mimosa*, several species of which grow in Texas, New Mexico, and Arizona. The species most common in Bexar County grows from 20 to 40 feet high and 18 inches thick. Charcoal is manufactured from it, and it is also made into handsome furniture, the grain being very fine. It grows where no other fruit-tree would live.

Basket osier.—Mr. A. N. Wallace, of Wyoming County, New York, eight years ago planted 2¾ acres with osier willow, (*Salix viminalis.*) The land was a light sandy loam and had been prepared by thoroughly plowing and harrowing, as for corn. The willow-cuttings, 8 inches long, were set 6 inches in the ground at an angle of 45° with the rows; the rows were 30 inches apart, and the distances between the sets in the row 6 inches. No fertilizers have been applied since planting, and there has been no cultivation except that given in the first season to a crop of beans planted between the rows. The first year's growth of osiers was cut and thrown away, and after that, on account of the scarcity of labor, no crop was taken until the third year, when the growth of two years was sold green and not peeled, at $12 per ton, averaging $131 per acre from a total crop of 30 tons. The fourth and fifth years' crops were sold at $120 per ton peeled, averaging $100 gross per acre. The sixth and seventh crops were sold green, amounted to 11 tons and 12 tons respectively, and brought $18 per ton, averaging $72 and $78.50 per acre. The crop of 1872 brought $20 per ton, green, the estimated yield being 5 tons per acre. At this price, with the present scarcity of labor, there is more profit in selling in the green state and not peeled, as the shrinkage in peeling and drying, with waste of small willows, amounts to 75 per cent. The average cost of cutting has been $12 per acre. The yield is very little affected by variations in heat and moisture, and there is no loss from insects.

Cheese-making in Texas.—A Mr. Brown who emigrated from Jefferson County, New York, to Erath County, Texas, began there experiments in cheese-making, in 1869. With rude apparatus, he made from thirty-five common Texas-range cows 1,000 pounds; lost 700 pounds of it, and

sold the rest for 35 cents per pound. In 1870, with better apparatus, obtained from the North, he made from forty cows of the same grade 2,000 pounds, and lost about 300. Inferring that the loss was not owing to climate, cows, or feed, but to improper management of the business in that untried climate, he improved the winter following in gaining information from the best authorities on cheese-making; procured Bavarian prepared rennet, and in 1871 tried again, with very satisfactory results, not losing 10 pounds. He estimates that with good management an ordinary Texas cow will make, during the season, 100 pounds of cheese, besides rearing a calf, and that at least $40 worth of pork may be raised on the whey from her milk, properly fed out.

An Ayrshire herd.—Mr. E. T. Miles, of Worcester County, Massachusetts, gives the following record of the milk product of his herd of ten Ayrshire cows from July 1, 1869, to July 1, 1872:

Year.	No. of cows.	Total weight of milk.	Average per cow.	Average per cow.
		Pounds.	*Pounds.*	*Quarts.*
1869-'70	7	43,998	6,285	3,010
1870-'71	8	48,870	6,109	2,984
1871-'72	10	57,812	5,781	2,769

At date of July 1, 1872, the ages of the cows ranged from four years to thirteen years.

Preserving action of boracic acid.—It has been found that boracic acid has a preservative action upon milk and beer, and it is stated that one gram (15½ grains) added to a quart of milk keeps it sweet and fresh in hot summer weather for one hundred and twenty hours, while milk not treated in this way will become sour in thirty-six hours. The addition of boracic acid to milk does not injure it for use, but the cream is separated far more slowly.

Roasted coffee as a disinfectant.—A recent French chemical publication speaks highly of roasted coffee as a disinfectant. The proper method of use for this purpose is to dry the raw bean, then pound in a mortar, and afterward roast the powder on a moderately-heated iron plate until it assumes a dark hue. It has been used successfully for purifying tainted air in the milk-room.

English sparrows in Australia.—It appears from complaints received by the Royal Horticultural Society of England that the sparrows imported from that country into Australia have inflicted serious injury on fruit crops.

A Parisian flower-market.—The business of the Madeleine flower-market—the best of the six or seven flower-markets of Paris—is said to amount to nearly £24,000 per year.

FARM EXPERIMENTS.

MANURES ON WHEAT AND BARLEY.

The following is a selection from a report of experiments made by Messrs. H. F. & A. Harwood, at Ipswich, England, in 1872, on light land which had been cropped in 1870 with wheat, manured with 10 tons of farm-yard dung per acre, and in 1871 with barley, manured with 5 cwts. of mixed artificial manures per acre. This barley crop having been removed, equal plots were measured off, various manures applied, at a cost of £3 10*s.* per acre, in each case, and wheat sown. Other plots were marked off for barley. The table gives the descriptions of manures and the quantities applied per acre, and the results obtained. The superphosphate received by wheat plots 14 and 15 contained, respectively, 28 per cent. and 17 per cent. of soluble phosphates. In addition to the merchantable grain represented in the column of yield, there was a small amount of refuse grain, the value of which is included in the statements of total values of the crops.

	Description of manures.	Per cent. of ammonia, (nitrogen equivalent to—)	Amount of manure per acre.	Price of manure per ton.	Grain per acre.	Weight per bushel.	Value of grain per acre.	Total value of grain, straw, and chaff, per acre.	Net profit of manured over unmanured.	Loss.
	EXPERIMENTS ON WHEAT.									
			Tons.	£ s. d.	*Bushels.*	*Lbs.*	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	Dung from open cattle-yard	.60	11 2-3	0 6 0	31	59	10 15 2	14 1 2	1 3 0½	....
2	Dung from covered cattle-yard	.77	11 2-3	0 6 0	35	59	11 14 7	14 8 11½	1 10 10	....
3	Shoddy, (factory-waste, manipulated)	7.72	1 1-6	3 0 0	34 3-4	60	11 19 11½	15 0 4	2 2 2½	....
9	Peruvian guano	10.96	7-27	13 10 0	31 1-2	60	11 0 0	13 3 6	0 5 4½	....
10	Unmanured	......	....	....	22 1-2	59	7 12 6	9 8 1½	....	....
11	Sulphate of ammonia	24.50	7-40	20 0 0	38 1-2	61	13 7 5	16 4 9½	3 6 8	....
12	Nitrate of soda, (applied in autumn)	19.50	7-37	18 10 0	32	60	11 1 2	13 1 8	0 3 6½	....
13	Ground rape-cake	5.08	1-2	7 0 0	31 3-4	60	10 19 5½	13 0 4	0 2 2½	....
14	Superphosphate of lime	......	7-10	5 0 0	25 1-2	59	8 10 1¾	10 0 10¼	....	2 17 2⅔
15	......do	......	7-9	4 10 0	26 2-3	60	9 4 8	10 19 11	....	1 18 2½
16	Patent ammonia	14.90	7-24	12 0 0	38 1-2	60	13 4 5	16 2 2	3 4 0½	....
17	Nitrate of soda, (applied in spring)	19.50	7-37	18 10 0	39 1-5	59	13 6 1	16 9 5½	3 11 4	....
	EXPERIMENTS ON BARLEY.									
18	Dung from open cattle-yard	.46	11 2-3	0 6 0	38 1-4	54	9 11 3	11 6 6	....	1 19 8
19	Dung from covered cattle-yard	.77	11 2-3	0 6 0	43 1-4	54	10 18 2	12 15 2	....	0 11 0
22	Unmanured	......	....	....	37 1-2	52	9 4 2	11 6 2	....	....
23	Nitrate of soda	19.50	7-37	18 10 0	48 2-3	53	12 7 10½	15 1 1½	1 14 11½	....

Applications of this exhibit to American practice will, of course, be modified by prices of manures and values of wheat and straw in different localities.

ECONOMICAL USE OF COSTLY NITROGENOUS MANURES.

English experimentalists have found that in general not one-half of the nitrogen of such manures as guano, ammonia salts, and nitrate of soda, is recovered in the increase of the crop to which they are applied. As to the residue, a portion may remain comparatively inactive in the soil, and a considerable portion may, under conditions favorable to drainage, be carried away and lost. With a view to these points, experiments were commenced at Rothamsted, England, in 1871, to determine whether any economical advantage can be gained by applying such manures in comparatively small quantities near the seed, instead of larger amounts broadcast and harrowed in. In the following tabulated experiment with wheat, the plots measured one-quarter of an acre each, and the amount of seed in each case was one bushel per acre. The fertilizers in this and the barley experiment were intimately mixed with ashes of burned clay before application. The 146 pounds sulphate of ammonia applied on plot 2 contained nitrogen equal to that contained in 15 bushels of wheat, with straw in proportion, and the imperfect recovery of the nitrogen is indicated by the fact that the yield on this plot was only 7¾ bushels per acre in excess of that of the unmanured plot. That the soil cannot be expected to return any large additional percentage of the nitrogen in seasons subsequent to that of the application has been already shown by experiments at Rothamsted. In his report for 1864, Mr. Lawes says that the unexhausted residue of nitrogen supplied in ammonia salts was but very partially and very slowly recovered in increase of crop in succeeding years, even with liberal applications of such mineral manures as were very effective when used in conjunction with newly-applied ammonia salts.

Plots.	Manures per acre, &c.	Wheat per acre.	Weight per bushel.	Straw per acre.
		Bush.	*Lbs.*	*Cwt.*
1	Unmanured, (seed dibbled 6 inches apart in the rows)	23¾	59.3	24½
2	146 pounds sulphate ammonia, (holes dibbled 6 inches apart, in rows, manure put in, and seed above)	31½	59.1	36¼
3	292 pounds sulphate ammonia, (broadcast, seed dibbled 6 inches apart in rows)	28¾	58.3	35⅝

The subjoined is a tabulation of experiments on barley. The plots were one-half of an acre each; amount of seed, 3 bushels per acre, except on plot 5, which received 1½ bushels of seed per acre.

Plots.	Manures per acre, &c.	Barley per acre.	Weight per bushel.	Straw per acre.
		Bush.	*Lbs.*	*Cwt.*
1	Unmanured; seed drilled	40½	53.9	24⅜
2	One hundred-weight superphosphate; one hundred-weight nitrate soda; manure broadcast; seed drilled	49⅞	53.3	30¼
3	One hundred-weight superphosphate; one hundred-weight nitrate soda; manures drilled; seed above	49½	53.4	28¼
4	One hundred-weight superphosphate; one hundred-weight nitrate soda; manures (with clay-ashes as usual) and seed mixed and drilled together	51	53.0	30⅜
5	One hundred-weight superphosphate; one hundred-weight nitrate soda; holes dibbled six inches apart in rows; manures put in, and seed above	51¼	53.3	28¾
6	Two hundred-weight superphosphate; two hundred-weight nitrate soda; manures broadcast; seed drilled	56¼	51.6	32⅞

FERTILIIZERS ON OATS.

The following is a summary of the experimental statement of Mr. J. B. Lawes on the effect of different fertilizers on oats grown on the same land during the three years from 1869 to 1871, inclusive, at Rothamsted, England: The previous croppings were, 1847 and 1848, clover dressed with different manures; 1849 to 1859, beans, with different manures; 1860, fallow; 1861 and 1862, wheat, unmanured; 1863, fallow; 1864, beans, dunged; 1865, wheat, unmanured; 1866, beans, unmanured; 1867 and 1868, wheat, unmanured. The area of the experiment was three-quarters of an acre, which was divided into six plots. As to applications per acre, plot 1 was not manured; plot 2 received 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, and 3½ cwt. superphosphate of lime made from 200 pounds bone-ash, 150 pounds sulphuric acid of 1.7 specific gravity, and water; plot 3 received 400 pounds ammonia salts, composed of sulphate and muriate of ammonia of commerce in equal parts; plot 4 received 400 pounds ammonia salts, 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, and 3½ cwt. superphosphate; plot 5 received 550 pounds nitrate of soda, (containing the same amount of nitrogen as four hundred pounds ammonia salts;) plot 6 received 550 pounds nitrate of soda, 200 pounds sulphate of potash, 100 pounds sulphate of soda, 100 pounds sulphate of magnesia, and 3½ cwt. superphosphate. The table gives results per acre:

	1869.			1870.			1871.			Average for three years.		
	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.	Oats per acre—bushels.	Weight per bushel—pounds.	Straw per acre—cwt.
1	36⅝	36¾	19¼	16⅜	35	9⅛	20½	33¼	11¼	24½	35	10⅞
2	45	38¼	24½	19⅛	35⅛	9⅝	22	35¼	13½	28¾	36¼	15⅞
3	56⅛	37½	36⅞	30	34⅞	17¼	57¼	36⅜	40⅝	47¾	36¼	31⅝
4	75¼	39¼	54	50⅝	36	28⅝	58⅝	35⅞	50	61½	36⅞	44¼
5	62¼	38½	42¾	36½	35¼	23	55	36⅝	34¾	51¼	36¾	33½
6	69⅞	38½	49⅞	50	35¾	28¾	60¼	33¾	48⅜	59⅞	36	42½

POTATO EXPERIMENTS IN SCOTLAND.

The following is an abstract of a report of experiments made by Mr. Yool, of Coulard Bank, Morayshire, Scotland: The soil was a good clay loam of very even quality, in "very moderate agricultural condition," the subsoil a light sandy loam. The field was divided into sixteen plots of one-eighth of an acre each. Furrows were laid out, 27 inches apart, the manures were placed in the bottom of these furrows, and potatoes of the regent variety were dropped thereon, 10 inches apart, May 1, 1871; the potatoes were then covered by running the plow through the ridge made between the furrows and throwing back the earth, according to the current practice of the region. The after-cultivation consisted of hand and horse hoeing, and finally earthing up. The potatoes were dug November 2, were sorted over a 1⅝-inch riddle,

and the large and small were separately weighed and pitted. At this time no diseased tubers were observed. On the 15th of March they were taken from the pits, the diseased tubers thrown out and the sound ones weighed. The diseased tubers amounted to about one-third of the whole crop, the proportion not varying greatly between the different plots, but being somewhat greater in the plots which received dung than in those which received artificial manure alone. The table shows the manures applied and the results obtained per acre, given substantially in the order of largest yield. The left-hand column indicates the relative locality of each plot:

Plots.	Manures per acre.	Large potatoes per acre.				Total of large and small potatoes per acre.			
		Tons.	Hundred-weight.	Quarters.	Pounds.	Tons.	Hundred-weight.	Quarters.	Pounds.
5	4 hundred-weight sulphate of ammonia, 4 hundred-weight dissolved coprolites	9	19	0	8	12	3	1	12
4	2 hundred-weight sulphate ammonia, 4 hundred-weight dissolved coprolites, 2 hundred-weight kainit	7	15	1	12	10	0	0	8
9	2 hundred-weight sulphate ammonia, 4 hundred-weight dissolved coprolites	7	7	2	8	9	9	0	16
16	16 loads dung, 2 hundred-weight sulphate ammonia, 3 hundred-weight dissolved coprolites, 2 hundred-weight kainit	7	9	1	4	9	6	0	16
1	Do	7	4	3	12	9	5	3	20
10	4 hundred-weight sulphate of ammonia	7	2	2	0	8	18	3	4
8	4 hundred-weight sulphate ammonia, 4 hundred-weight kainit	6	6	2	24	7	18	0	16
15	16 loads of dung	5	6	2	16	6	14	1	20
2	Do	5	5	3	12	6	11	2	8
6	4 hundred-weight dissolved coprolites, 4 hundred-weight kainit	4	18	0	8	6	6	2	16
13	4 hundred-weight kainit	4	0	1	12	5	5	3	12
14	No manure	4	0	3	4	5	4	2	16
7	Do	3	19	2	24	5	4	2	0
3	Do	3	18	1	12	5	0	2	24
11	Do	3	15	0	0	5	3	3	20
12	4 hundred-weight dissolved coprolites	3	16	1	4	5	6	2	16

The sulphate of ammonia contained 24 per cent. of ammonia; the dissolved coprolites, 26 per cent. of soluble and 5 per cent. of insoluble phosphate; and the kainit, or German potash-salts, 24 per cent. of sulphate of potash.

FERTILIZERS FOR SUGAR-BEET.

Experiments were made at Rothamsted, England, in 1871, in applying different manures for sugar-beet. The previous croppings were, 1843 to 1852, Norfolk white turnips and Swede turnips, with different manures; 1853 to 1855, barley, without manure; 1856 to 1870, Swede turnips, with manures similar to those used in the following described experiments. The area under experiment consisted of about 8 acres divided into 40 plots, arranged in five series of eight plots each. The manurial applications per acre in series 1 were: Plot 1, 14 tons farm-yard manure. Plot 2, 14 tons farm-yard manure and 3½ cwt. superphosphate of lime. Plot 3 received no manure, and had not been manured for thirty years. Plot 4, 3½ cwt. superphosphate, 300 pounds sulphate of potash, 200 pounds sulphate of soda, and 100 pounds sulphate of magnesia. Plot 5, 3½ cwt. superphosphate. Plot 6, 3½ cwt. superphosphate and 500 pounds sulphate of potash. Plot 7, 3½ cwt. superphosphate, 500 pounds sulphate of potash, and 36½ pounds ammonia salts. Plot 8, no manure since 1853; previously, a part unmanured

and part dressed with superphosphate. Series 2 to 5 received the same applications as series 1, with the addition of the cross-dressings named in the table.

Plots.	Product per acre, (roots trimmed as for feeding, not for sugar-making,) 1871.									
	Series one.		Series two, cross-dressed with 550 pounds nitrate soda.		Series three, cross-dressed with 400 pounds ammonia salts.		Series four, cross-dressed with 2,000 pounds rape-cake and 400 pounds ammonia salts.		Series five, cross-dressed with 2,000 pounds rape-cake.	
	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
	Tons. cwt.	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*	*Tons. cwt.*
1	18 3	3 5	27 13	6 19	22 1	5 6	26 4	6 14	28 18	5 14
2	14 13	2 14	25 16	5 15	21 15	4 6	25 2	6 7	25 4	5 5
3	7 11	2 0	22 3	5 12	15 6	4 16	19 18	7 0	20 16	4 12
4	7 11	1 5	22 15	4 8	17 10	3 5	22 15	6 3	21 7	3 19
5	5 12	1 8	20 19	3 14	15 4	3 19	19 18	7 12	18 19	4 5
6	5 1	1 4	21 5	3 13	17 4	3 4	23 11	6 11	21 0	3 11
7	5 18	1 5	20 19	3 18	18 8	4 3	21 0	5 0	21 7	3 17
8	7 10	1 14	21 13	3 16	16 2	4 15	17 19	7 11	20 7	4 9

RETENTION OF PHOSPHORIC ACID.

The following is a summary of a report by Professor W. Le Roy Broun, of the University of Georgia, on recent experiments at that institution, in testing the question of the leaching of phosphoric acid from the soil by heavy rains: Strong solutions of monobasic phosphates, obtained from commercial manures by dissolving superphosphate in water, were filtered through small quantities of red clay taken from a house-cellar and thoroughly dried. The filtrated liquid, tested by molybdate of ammonia, contained but the slightest trace of phosphoric acid; and though an excess of water, in imitation of a drenching rain, was afterwards applied to the soil, yet the phosphoric acid remained where it was first placed, showing that clay soils are substantially complete absorbents of this fertilizing element.

DEEP PLOWING.

The Kansas Farmer states that in the autumn of 1869 a Mr. D—— plowed 37 acres of land from twelve to fourteen inches deep, using six horses. Wheat was sown in September, and made a good growth that fall. The next season was very dry, but this wheat appeared to suffer no marked injury, and yielded 40 bushels per acre, while on adjoining land, plowed shallow, the average was not more than half as large. In his next experiment he added to these 37 acres an adjoining field of 40 acres, and plowed the whole to a somewhat greater depth than that above mentioned, using a team of eight horses, four abreast. The growth was very fine and even, and the average yield was a little over 30 bushels per acre.

RETENTION OF MOISTURE BY DEEP TILLAGE.

Nessler states, as the results of his experiments in deep culture, that a soil tilled to the depth of 12 inches lost only one-third of the quantity of water evaporated from an unstirred soil, and soil barely loosened retained 50 per cent. more water than the unbroken soil. The tilled soil

was drier at the surface than the compact soil, but at the depth of one foot is more humid than the latter, the upper layer of cultivated earth serving as a screen or mulch to the sub-layers. It is in accordance with the principle thus illustrated that the roller, passed over the field after sowing, secures to the seed-bed a suitable moisture; stirring the soil by harrows, &c., being in order when the roots have struck into the layer below.

DEEP TILLAGE FOR A COURSE OF YEARS.

Mr. Samuel M. Wherry, of Shippensburgh, Pennsylvania, reports his experience in subsoiling for eight years on a rolling upland farm, possessing a rich heavy clay soil 6 to 8 inches deep, with a yellowish red clay subsoil almost impervious to water and impenetrable by plant-roots. Limestone crops out frequently and nowhere lies more than 4 to 8 feet below the surface. The following is his statement of the effects of deep tillage on his crops:

Corn.—In ordinary seasons no appreciable gain in yield, but in seasons of extreme drought a gain of 30 to 50 per cent. In all seasons there is a notable disposition on the part of the corn on subsoiled ground to continue green, not even the blades turning brown until the frost comes. Consequently the ears do not harden so well on the standing corn, and care is required in cutting up. But the corn comes out in good condition at husking-time, and the fodder is excellent.

Wheat.—A slight gain in yield, due to increased length of head. The straw is much stiffer and brighter, and the grain ripens from six to eight days earlier. This last is a decided advantage here.

Timothy and clover—separate and mixed.—A large increase in yield, but greatly at the sacrifice of quality. In dry seasons, such as 1866 and 1871, a gain of 100 per cent. The stems on subsoiled ground are much longer, coarser, and harder to cure, while the leaves have a peculiar and very distinct sickly bluish-green color. Clover never seems to reach a state of maturity—never comes to full bloom—for the reason that green stems are all the while shooting up and overshadowing the blossoms. In 1870 subsoiled land, after first mowing, bloomed simultaneously and yielded a fair crop of clover-seed. The other half of the field was barren. The season was dry. It is certain that cattle and sheep prefer the subsoiled side of the field in pasturing the aftermath, (the only pasturing done.)

Miscellaneous particulars.—Spring plowing can be commenced on subsoiled land from three to six days earlier than on land not subsoiled. After-plowings are much lighter on the teams, but the plow does not run so steadily, and the furrow breaks irregularly, leaving the plowed surface ragged and uneven. In plowing oat stubble for wheat, deep, (as is done,) considerable of the previously broken subsoil is thrown to the top in very hard lumps, necessitating much additional labor in preparing a proper seed-bed. This has been the most serious difficulty encountered.

The most curious fact observed is that the clover-plant on subsoiled land does not, as in unsubsoiled land, send down vertically a single long carrot-shaped tap-root ending in a straggling bunch of irregular rootlets; but the primary root begins almost immediately to divide off into many (six, eight, and ten) side branches, each of itself a perfect main or tap-root with side branches. These main roots do not descend vertically into the ground, but incline strongly outward from the primary, and fill the whole surface-soil with thread-like roots. The difference is quite observable some time after plowing is done, when the unsubsoiled parts are covered with the severed roots, standing upright in the air, while the subsoiled parts are, apparently, as devoid of roots as stubble ground. A closer inspection shows the true state of the case, and it is probable that a cubic foot of subsoiled ground will contain in weight more than twice as much root matter as a cubic foot of the unsubsoiled.

Mr. Wherry remarks that the question of deep tillage is not to be decided by the results of one or two seasons only.

IRRIGATION IN ENGLAND.

At Stoke Park, England, in 1871, 40 acres were put under irrigation, so managed as to temper the soil when dry weather came in, about the last of March, supplying moisture regularly, and in sufficient quantity

to prevent the surface from crusting. Two crops of hay, estimated at 5 tons per acre, were taken from this ground, and afterward, in August, 120 large Highland bullocks were turned in, averaging three bullocks per acre. These remained till November, receiving no food but the irrigated grass, and were kept in first-rate condition. On the contrary, 430 acres unirrigated became so withered and bare from the summer drought as to afford scarcely any food to cattle or sheep. In March, 1872, guano was applied on the irrigated land and on the adjoining permanent pasture, not irrigated, the quantity and quality of application being alike in both cases. On the irrigated land a thick growth of grass, 9 inches long, was produced, grazed in the first week of April. At this latter date there was no appreciable change in the growth of the adjoining pasture further than a change of color to a darker green.

FEEDING HOGS WITH CORN IN THE EAR AND COOKED MEAL.

Mr. J. M. Billingsley, of Spring Valley, Indiana, in the latter part of 1870 placed in his hog-house one of Anderson's steamers, and took twenty hogs, crosses of Chester White, Poland, and Berkshire, dividing them fairly, according to his best judgment, into two lots. Ten were fed with meal, cooked, 56 pounds to the bushel, as much as they would eat clean. The others were fed on corn in the ear, 68 pounds to the bushel. Except in these particulars of feeding the treatment was uniform throughout. The following table gives the result:

	Lot 1. Weight.	Cooked meal.	Gain.	Lot 2. Weight.	Corn in ear.	Gain.
	Pounds.	*Bushels.*	*Pounds.*	*Pounds.*	*Bushels.*	*Pounds.*
December 1, 1870	2,110	....	....	2,200	....	....
December 10, 1870	2,310	10	200	2,340	12	140
December 17, 1870	2,400	8	90	2,450	10½	110
December 24, 1870	2,470	8½	70	2,590	11	140
December 31, 1870	2,540	7	70	2,650	8½	60
January 7, 1871	2,610	7½	70	2,750	9½	100
January 14, 1871	2,670	7½	60	2,840	9	90
January 21, 1871	2,780	8½	110	2,960	11	120
			670			760

Average daily gain, per hog: Lot 1, 1.29 pounds; lot 2, 1.46 pounds. Average gain per bushel of corn: Lot 1, 1.18 pounds; lot 2, 1.07 pounds. The cost of shelling the corn, carriage to mill, grinding, and cooking must be charged against the cooked meal.

COOKED AND UNCOOKED FOOD.

Mr. L. R. Bingham, of Bloomington, Grant County, Wisconsin, states that having purchased an Anderson steamer he commenced, February 15, 1871, an experiment in feeding nineteen pigs about twelve months old, a cross of Berkshire with common stock. They had had previously the run of the farm, and for two months had had all the corn they could eat. Their united weight at the beginning of the experiment was 5,082 pounds. For twenty-eight days they were fed as before with corn in the ear and all the water they would drink. At the close of this period their total gain in weight was 667 pounds, made from

feeding 55 bushels of corn—a gain of 12 pounds for each bushel of corn. They were then fed with thick mush, made by bringing the water to a boiling heat and then stirring in the meal ground fine, with the steam still on, allowing the meal to cook five to ten minutes and adding salt; this was fed to them warm three times a day, as much as they would eat clean. At the end of twenty-eight days they were again weighed, showing a gain of 676 pounds made on 75 bushels of corn, less toll, a gain of 9 pounds for each bushel of corn consumed. He then put eleven of the pigs on raw corn again, continuing to feed the others with cooked meal. May 25, after a trial of six weeks, those on raw corn averaged a gain of 44 pounds each, and the others an average gain of 37 pounds.

FEEDING WHEAT STRAW.

The following account is drawn from an address delivered by Mr. J. S. Van Duzer, of Elmira, New York, before the Farmers' Club of that city, in October, 1872, on the merits of wheat straw as a component in winter feed for stock. Commencing the middle of December, 1871, his cows being then in fine condition, and drying off, he fed six quarts of wheat bran daily, with all the straw which the animals would eat, giving two meals per day and continuing this treatment six weeks. Afterward he changed the bran-feed to corn-meal and bran, one measure of the former to two of the latter giving four quarts of the mixture daily. This grain-feed was gradually increased toward calving, and a small allowance of hay was given in the morning after the straw and before the grain-feed. Under this treatment the animals maintained a good appetite and were kept in thriving condition. Mr. Van Duzer offers the experiment as an illustration of the advantages which would result from a judicious use of good bright wheat straw in times of high prices of hay. Though the experiment was confined to cows not in milk, he considers it as pointing to the more limited availability of straw in winter feeding of cows in milk and beef cattle. With these classes of stock the value of the wheat straw should be heightened by some such preparation as cutting or steaming, and more grain should be given. And with any description of stock there should be proper discrimination in management—feeding the straw chiefly in early winter, and from time to time making some variations in the composition of the feed.

ASSIMILATION OF PLANT-FOOD.

The results of experiments by M. Isadore Pierre show that at the period of blooming, the wheat plant reaches a maximum in the appropriation of nitrogen, iron, phosphoric acid, potassa, magnesia, and soda. Lime appears to increase till within fifteen days of maturity, and silica increases during ripening. The plant ceases to appropriate mineral elements (excepting silica) during the last thirty days of its growth.

DIGEST OF STATE REPORTS.

INDIANA.

The thirteenth annual report of the State Board of Agriculture contains the transactions of the board during the year 1871, the premiums offered and awards made at the annual State fair, reports from a large number of county and district societies, an essay on hog-feeding in winter, addresses on the mineral resources of the State, &c.

The annual fair, which was held at the fair-grounds near Indianapolis, from the 3d to the 8th of October, inclusive, was very successful, both in point of attendance and the number of articles exhibited. David M. Leer, of Grant County, was awarded the first premium on corn. He raised five acres, averaging 197 bushels and 22 pounds to the acre. Mr. Leer states that his land is a black loam, with clay subsoil. This yield is the third crop raised on the ground. No manures or fertilizers of any kind were used. The ground was plowed in the spring 10 inches deep, harrowed one way and rolled. Corn planted May 1, and the ground again rolled. The corn was plowed five times during the season. The first premium on wheat was awarded William Nagle, of Hamilton County, who raised 39¼ bushels on one acre of ground. Alfred Welton, of Knox County, raised 54 bushels of oats on one acre, for which he was awarded the first premium. The same gentleman was awarded the first premium for an acre of timothy grass; had raised on this amount of land 9,048 pounds, or four tons and 1,048 pounds.

Reports from upward of fifty district and county societies show them to be in a prosperous and flourishing condition.

Recent surveys by the State geologist show the block-coal regions of Indiana to be of much greater extent than preceding surveys indicated. In an address before the Chamber of Commerce of Indianapolis, delivered by Dr. J. W. Foster, of Chicago, the margin of this extensive and valuable coal-field is given as follows: Starting at a point on the western boundary of the State, (in Warren County,) about seventy-five miles south of Lake Michigan, the line is protracted thence in a southeasterly direction to the mouth of Deer Creek, a few miles above Cannelton, on the Ohio River. Within this area are included not less than twenty-four counties underlaid wholly or in part by the coal-measures. This, however, is but a portion of that great coal-field which stretches uninterruptedly west, to near the borders of the Mississippi River, including nearly two-thirds of Illinois, a large portion of Kentucky, and embracing a combined area of not less than sixty thousand square miles. * * * The assemblage of rocks, made up of coarse and fine grained sandstones, shales, fine clays, and limestones, which form the coal-measures, embraces a vertical thickness of about 600 feet, and within this range there are not less than six seams of workable coal, each of which will be found to have its own peculiar properties, and giving in the aggregate something like 22 feet of solid coal.

The annual report of the Indiana Horticultural Society for 1872 contains the transactions of the society for 1871, discussions on various subjects of interest to fruit-growers, reports from district committees and county societies, list of fruits recommended by the society for general cultivation, memoirs of the pioneer fruit-growers and nurserymen of the Ohio Valley, essays, &c.

The reports of the district committees showed a fair yield of fruit

throughout the State, with the exception of strawberries and peaches. On the 23d of April, when the strawberry plants were white with bloom, occurred a severe frost, which killed the bloom and seriously damaged the plants. This frost also damaged the peach crop, and being followed by an extremely dry summer the yield was meager and the quality of the crop very inferior. The apple, grape, and pear crops were very fine.

In a discussion on tree-planting, Dr. Furnas stated that many failures arose from a lack of knowledge as to how and when to plant. Trees should be carefully dug and transplanted to a well-prepared soil with as much dispatch as possible. Very little exposure to the air often makes very serious work, the more especially when done late in the spring, when the sun is getting strong, the ground dry and hot, and the sap already in motion, forming little rootlets which are easily killed. For this reason he recommends fall transplanting, and mounding up around the tree with clean earth to the height of 10 or 12 inches. This keeps the tree in place better than a stake; it also keeps the ground warm about the roots, prevents mice and rabbits from gnawing the tree, at any rate as high as the mound, and in case the trees are killed by a severe winter preserves the roots for the starting of a new tree. The mound should be removed in the spring. Mr. R. S. Rogan advised the planting of trees more closely than is the habit of fruit-growers generally. Apple-trees set one rod apart will bear profitable crops before they will interfere, after which every alternate tree may be taken out one way, and in a few years more the same the other way, thus leaving the permanent trees two rods apart, which is about the proper distance for most varieities. Mr. Rogan thinks that fruit-growers raise too many varieties of apples, especially if profit is the main object. He recommends the following list as comprising the most profitable varieties: Rawle's, Janet, Hoop's, Cannon Pearmain, Ben Davis, Rome Beauty, Pennock, Clayton, Tulpehocken, Rambo, Smith's Cider, and English Golden Russet. In this discussion three varieties of apples which originated in Indiana were highly recommended, viz: Indiana Favorite, Oceola, and Wiley Sweet. Mr. I. D. G. Nelson regarded the Ben Davis as the most profitable among the many varieties of apples he had cultivated. The tree is almost faultless; rarely ever splits or breaks down. The fruit is of uniform size, well colored, and large enough to sell readily for the best of prices. Mr. Nelson attributes the great disposition of the pear to blight to the over-rich soils of the West, stimulating the tree to an unhealthy excess of wood-growth. Mr. S. W. Pearson said he had succeeded better with the pear than with the apple. By planting trees 16 feet apart he got double the quantity from the same amount of ground. The secretary thought that too many varieties were grown. Like most fruit-growers, he had learned a sad lesson by experience with too many varieties. He said:

I presume my former pear-orchards of seven hundred trees contained over one hundred sorts, while the profits were mainly confined to about one dozen varieties. These were about as follows, and profitable in the order in which they are named: Flemish Beauty, Bartlett, Beurre d'Anjou, Onondaga, Howell, Sheldon, Vicar of Winkfield, Doyenne Boussock, Beurre Clairgeau, Lawrence, Buffum, and Belle Lucrative. Seven crops in succession, from one tree of the first-named variety, have netted $201.50.

During the discussion on pear-culture the celebrated Occletree pear-tree, near Vincennes, was mentioned. This tree was planted by the early French settlers, and is now over one hundred years old. It is said to have yielded, in 1834, 140 bushels of pears.

In an essay on the profits of fruit-culture Mr. T. J. Templin says:

It is from the aggregate products of many trees or orchards that we are to determine whether fruit-culture, as a business, will pay. Let us take a glance at the value of a young orchard. At 30 feet apart, there will be about 50 trees to the acre. At ten

years from setting, these trees, if properly cared for, are worth, at a low estimate, $10 each. The fruit produced up to this time will, on an average, pay all expense of care and culture. Here, then, is a clear gain of $50 per acre for each year since setting, and a present value of $500 per acre added to the value of the land. For an orchard of ten acres this would give us $500 yearly increase, and a present value of $5,000 besides the value of the land. On a farm of 160 acres this would give an annual increase of $6,000, and a present value of trees of $6,000. For the next five years these trees ought to yield an average of two barrels of apples per year, which, at only $1 per barrel, would give an annual income of $100 per acre, besides $50 for the growth in value of trees. At fifteen years of age we have an orchard worth $750 per acre, and have obtained fruit to the value of $500. Now, suppose it takes all this to pay expense of care, harvesting, marketing, &c., we still have built up an orchard worth $7,500 for every ten acres so occupied.

In an address before the society on the strawberry and its culture Mr. W. C. Flagg stated that while the American species of strawberries cross freely among themselves, they cross with difficulty, and frequently not at all, with European species. Even upon European ground they have proved so superior in many respects to the European sorts that they have replaced them in the gardens and markets of the Old World.

Report of 1872.—The fourteenth annual report of the Indiana State Board of Agriculture for the year 1872 contains, among other things, the business transactions of the board, proceedings of the convention of short-horn breeders of the State, a list of the premiums offered and awarded at the State fair, a large amount of interesting agricultural statistics, essays on various subjects, reports from county and district societies, proceedings of the National Swine-breeders' Association and the National Convention of Short-horn-cattle Breeders, both of which conventions were held in Indianapolis during the year, and, also, the report of Mr. E. T. Cox, State geologist, for the years 1871-'72. The two reports combined make 917 pages.

Mr. J. D. Williams, president of the board, in an address delivered at the January meeting, alludes briefly to the importance of the report of the State geologist, who has completed a thorough survey of the block coal-fields of Sullivan, Daviess, and Martin Counties, and partial surveys of other sections of the State. The iron-smelting or block-coal deposits, which had previously been traced from the northern limits of Greene County, have been followed along the eastern margin of the field to the Ohio River, making in all an area of about 288,000 acres. The quantity of coal available for market purposes in the three counties surveyed in detail is estimated at not less than 8,371,217,916 tons. Extensive deposits of iron-ore are also reported in Martin County, two of which are said to be 30 feet in depth.

The annual State fair, which opened on the 30th day of September, and continued for six days, was one of the most successful exhibitions ever held in the State. The whole number of entries amounted to over four thousand, about one thousand in excess of the previous year. Much interest was manifested in the live-stock department, and some of the best horses, cattle, sheep, and hogs in the United States were on exhibition. The animal which attracted most attention was a short-horn Durham heifer, raised and owned by Messrs. A. C. & G. Shropshire, of Paris, Kentucky. She is represented as a most beautiful animal, and perfect in every point. Her owners value her at $12,000. Black Eagle, a beautiful animal of the Gray Eagle stock, and owned by the same gentlemen, also attracted much attention. R. L. Cornthwaite, of Wayne County, exhibited a span of draught-horses, five years old, which weighed, respectively, 1,784 and 1,840 pounds. The fair was suc-

cessful in a financial point of view, as well as in the many superior articles exhibited.

Reports from county and district societies show these organizations to be in a healthy and prosperous condition. The number of such societies in the State is about fifty, from which reports have been made by forty-five.

At the January meeting of the board an interchange of views was had among the members upon the questions of seeding ground to clover and flax at the same time, and upon early and late plowing for corn. Upon the first question there was quite a diversity of opinion. Some had found that the flax so shaded the clover as to kill it. Others had been successful, and found that the flax did not interfere with the clover to any greater extent than oats. As to early and late plowing, the testimony was almost unanimously in favor of late plowing for corn, many giving it as their experience if the ground were broken up after vegetation had well started, say as late as the 20th of May, they secured perfect immunity for their corn crop from the cut-worm. One gentleman had divided a field, plowing one-fourth in the fall, one-fourth on the 1st of May, and the remainder about the 20th of the same month. In sections plowed in the fall and early spring the cut-worms destroyed the entire set, while in the half of the field planted late only a few hills along the edge required to be replanted.

In compliance with a resolution adopted at the March session of the board, a trial of implements used in the preparation of ground and the cultivation of crops was held at Indianapolis, commencing on the 10th and continuing up to and including the 13th of June. There were one hundred and sixty-four entries of plows, cultivators, grain-drills, rollers, harrows, planters, dynamometers, &c. Premiums amounting in the aggregate to $220 were disbursed. The exhibition was very successful, and its regular continuance from year to year is recommended by the board.

A convention of the cattle-breeders of the State was held at Indianapolis on the 21st of May. The convention was largely attended, and much interest seemed to be taken in all its proceedings. Dr. Stevenson, of Greencastle, presided, and on taking the chair delivered quite an elaborate address on the subject of the breeding and rearing of short-horns. In giving the points of a pure or thorough-bred, he said that the general contour of the body should be nearly a square. The crops should be wide; the line of the back straight; the line of the belly nearly so, swelling a little behind the ribs; the flank low; the ribs barrel-shaped; the loins wide, and the rump long and wide; the back should be wide; the thigh long and wide; the legs short and comparatively small, or at least not coarse; tail light; hair soft and fine; skin thick, soft, and elastic. The color should be red or white, or a mixture of the two, as roan or pied. In answer to the question as to whether short-horns can be improved, Dr. Stevenson said:

If these cattle are not susceptible of improvement, then the breed is perfect, and that perfection implies perfect uniformity. That this breed is not perfectly uniform does not admit of a doubt. If not uniform, then they are not perfect, and are susceptible of improvement just as any other imperfect breed of animals are. That they are no better now than they were a century ago, is no proof that they are not susceptible of improvement. The proper inference is, that breeders have failed to adopt such a course as would accomplish it. And there are reasons palpable enough why breeders have thus failed. The great merit and deserved popularity of the breed, commencing with the Collings, has been the prime cause. The great demand for them has resulted in throwing upon the country all the bull-calves, good and bad, as breeders; consequently, many bad bulls have been used, to the great damage of the breed as a whole. The high price paid for these cattle has turned all the breeders into speculators, and,

consequently, few have sought and practiced the art of breeding; and the true test of value, which is the shambles, has been neglected. The price now is too frequently made the test of merit. Under such influences, short-horns are in great danger of deterioration. * * * The breeder must know what constitutes a first-rate short-horn. Then the great principle is, that like begets like. Therefore, he must select the best, and none but the best, as breeders. There is no herd of cattle, or even a family, but there are better and worse cattle in it. The best should be retained and bred, and in the course of thirty years' breeding this will be a better herd than at the commencement. That these cattle are susceptible of improvement there can be no doubt. There can scarcely two animals be found of like quality in all their points. One will be better in a certain point than the other, and worse in another; and an inferior animal may be better in a point or two than the most superior. There is a certainty, therefore, that improvement may be made.

In a discussion which followed the delivery of this address, Mr. W. W. Thrasher alluded to the importance of good handling-qualities. His attention was first called to the matter at a fair in 1854, when he served as one of the judges. Some seventeen heifers were brought into the ring looking as much alike as so many eggs; but in handling-qualities they were quite different. From experience, since gained, he knew good handlers made better beef than hard handlers. General Meredith coincided with the speaker. He thought there was a great deal in handling-qualities. Those soft to the touch fattened more readily than the hard handlers, and brought higher prices everywhere. Many hard handlers thrived well, but in consequence of the discrimination against them in the market it was not profitable for breeders to produce animals of this character. The feeding qualities, in his opinion, went with the handling, as a general rule, although there were undoubtedly exceptions. In thirty years' experience he had never known a hard handler to be a superior milker. Mr. Lowder spoke of the superior qualities of short-horns as milkers. He said that some men regarded short-horns as worthless for milk and butter, and especially for butter. There are some families of which this is true; and many, who had been so unfortunate as to get these cattle, believe they have tested the milking qualities of the short-horns, when really they have done no such thing. There are some families of short-horns which are as good milkers as can be found in the world—as good milkers as the Ayrshire in regard to quantity, and the Jersey in regard to quality. He had a cow which yielded 22½ pounds of butter in ten days; and this same cow fattened very quickly. Mr. Thrasher said the Ayrshires were better average milkers, but when a good short-horn milker was found, she would prove much more valuable than an Ayrshire. He never knew a good short-horn milch cow which was not also a good feeder.

On the second day of the convention a constitution and by-laws were adopted, the fifth article of which provides for an annual meeting of the short-horn breeders of the State on the fourth Tuesday in May. After the adoption of the constitution the subject of grazing was taken up, and discussed at length. Mr. Lowder alluded to the necessity of grazing becoming more general. The continual taking of crops from the soil tends to its impoverishment, and the consequent impoverishment of the people. Mr. Thrasher spoke of blue-grass pastures, and said they should be well treated, and not overstocked. With proper treatment the older it gets, the better. A portion of the pasturage should be set apart ungrazed in summer for use in the winter season. He regarded the short-horns as the most profitable to raise. With the same keep, care, and treatment as common stock, short-horns will make the most beef, and beef which will sell for more.

The president expressed his high appreciation of the economic advantages of grazing to the country. The grazing of common cattle

was his principal business, and had been for a great many years, and he felt qualified to express an opinion on the comparative merits of short-horns and common stock for grazing purposes. He had thorough-bred steers which sold for $8.50, when the market for best common beef-cattle was but $6 per hundred, and some times 13 cents per pound had been realized for his Christmas steers. He believed in raising short-horns for the shambles, and knew from extended personal experience that it could be done with greater profit than raising common stock. For a long series of years the results of raising short-horns had realized profits fully 50 per cent. greater than he had been able to secure from grazing common stock on the same pastures; and the farmer who raised short-horns for beef had fully 50 per cent. advantage over his neighbor who raised common stock. In reference to grazing he said that entire reliance should not be placed on blue-grass. From years of observation he had found that a pasture of mixed clover and timothy would, during the months of May and June, put more flesh on cattle than blue-grass; but he would not recommend this for later pasturage. The greatest difficulty encountered by graziers was the short pasturage from the last week in July to the first week in September; and if any one could discover a grass which would provide good pasturage during this period he would confer a great blessing on the country. The best pasturage he had been able to provide for bridging over this gap was red clover and orchard grass. The "English blue-grass," as it was called in his part of the country, but which, he believed, was the perennial rye-grass, was also very valuable at this time. Red-top he had a very poor opinion of for any purpose. General Meredith coincided in this view, and regarded red-top as comparatively worthless. The last-named gentleman thought that the earliest grass had very little strength in it, and he believed in feeding cattle a little grain when first turned to grass in the spring; believed in it because it paid to feed it.

Mr. Delos Wood, in the course of an essay on underdraining, recites the following experiments made on drained and undrained land:

> The summer of 1871 was so exceedingly dry that I was often told that I would get nothing from that field, (recently underdrained,) but, on the contrary, it produced all the really good corn I had, while that adjoining, on the same kind of soil, and with precisely the same kind of treatment, except the draining, rolled up and then burned up. Not a leaf on the drained land curled until the corn was nearly ready to cut. At the harvesting the contrast was still more striking; that on the drained land averaged 90 bushels of shelled corn per acre, while on the undrained it was not over 35. This year it is in corn again, with precisely the same results. Last fall I plowed the undrained part up into ridges, and left it to the action of the frost, then plowed it again in the spring; but it has not produced one-half as much corn as the other. Its effects upon other crops are also well-marked. In wheat, winter-killing is almost done away with, as it is only on wet, heavy soils that heaving takes place, and as vegetation of all kinds starts earlier on the warm, dry soil of the drained land, wheat is usually ripened in time to escape the rust.
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> A neighbor who has been experimenting on the effects of underdraining on different crops, planted a small plat of potatoes upon a drained field, from which he dug 45 bushels. In an undrained field of the same kind of soil, he measured off six times the same amount of ground, planted it with the same kind of potatoes, and gave them the same cultivation, from which he dug 52 bushels.
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> The grass crop is not so much increased in quantity as improved in quality, the hay being of the very best, while all danger of its being displaced by sedge and other semi-aquatic grasses is destroyed. Usually, in our climate and soil, clover suffers the second season quite as much as wheat from the extreme alternations of freezing and thawing, which throws the roots out of the ground, breaking the small, fibrous, working roots, and thus killing the plants.

In an article on the progress of manufactures in the State, the secretary states that three of the principal sewing-machines now in use are manufactured in Indiana, viz: The Wheeler & Wilson, the Singer, and

the Howe sewing-machine. The buildings of the Howe company, located at Peru, were destroyed by fire in 1871, and were rebuilt and in operation in sixty days. This company employs five hundred men.

The National Swine-Breeders' Association met in Indianapolis on the 20th day of November. Delegates were in attendance from the States of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Pennsylvania, and New York. A committee appointed at the May meeting of the State Swine-Breeders' Association, to prepare work for the convention and to name committees to determine upon the history and characteristics, and to prepare a scale of points for the respective breeds of swine, and upon the question of what constitutes thorough-breds, named committees on the following subjects and points: 1. What constitutes thorough-bred swine? 2. On Berkshires; 3. "Improved Cheshires or Jefferson County;" 4. Chester Whites; 5. Essex; 6. Neapolitan; 7. Magie or Poland-China; 8. New Jersey Reds; 9. Suffolks and other small white English breeds; 10. Yorkshires and other large white English breeds; 11. Victorias.

The committees made elaborate reports on the various subjects referred to them for consideration. As a general thing the reports are too lengthy for reproduction in this volume, and we can find room only for the conclusion, or that portion wherein the characteristics or points of each distinct and well-defined breed is given. The committee, after stating that the Poland-China breed can be relied upon for the production of a progeny of like qualities and character, give the following characteristics:

The best specimens have good length, short legs, broad straight backs, deep sides flanking well down on the legs, very broad, full, square hams and shoulders, drooping ears, short heads, wide between the eyes, of spotted or dark color; are hardy, vigorous and prolific, and when fat are perfect models all over, pre-eminently combining the excellencies of both large and small breeds.

The committee on the Berkshire breed submit the following characteristics and markings:

Color black, with white on feet, face, tip of tail, and an occasional splash of white on the arm, while a small spot of white on some other part of the body does not argue an impurity of blood, yet it is to be discouraged to the end that uniformity of color may be attained by breeders; white upon one ear, or a bronze or copper spot on some part of the body argues no impurity, but rather a re-appearance of original colors. Markings of white other than those named above are suspicious, and a pig so marked should be rejected.

Face short, fine, and well dished; broad between the eyes. Ears generally almost erect, but sometimes inclining forward with advancing age; small, thin, soft, and showing veins. Jowl full. Neck short and thick. Shoulders short from neck to middling, deep from back down. Back broad and straight, or a very little arched. Ribs—long ribs well sprung, giving rotundity of body; short ribs of good length, giving breadth and levelness of loins. Hips, good length from point of hip to rump. Hams thick, round, and deep, holding their thickness well back and down to the hocks. Tail, fine and small, set on high up. Legs, short and fine, but straight and very strong, with hoofs erect, legs set wide apart. Size, medium. Length, medium; extremes are to be avoided. Bone, fine and compact. Offal, very light. Hair, fine and soft; no bristles. Skin, pliable. The Berkshires are hardy, prolific and excellent nurses; their meat is of a superior quality, with fat and lean well mixed.

The following are given as the points of Neapolitan swine:

Head small; front head bony and flat; face slightly dishing; snout rather long and very slender; ears small, thin, standing outward and forward nearly horizontally, and quite lively; jowls very full but not large; neck short, broad, and heavy above, with small dewlap; trunk long, cylindrical, well-ribbed back; back flat, and ribs well arching even in very low flesh; belly horizontal on lower line; hind-quarters higher than fore, but not very much so; legs very fine, the bones and joints being smaller than those of any other breed; hams and shoulders well developed and meaty; tail fine, curled, flat at extremity, with hairs on each side; general color slaty or bluish plum color, that is, dark blue, with a cast of coppery red; skin soft and fine, nearly

free from hair, which, when found upon the sides of the head and behind the fore-legs, is black and soft and rather long; flesh to the feel fine and elastic.

Disqualifications.—1. Any color except uniform black, slate color, plum color or coppery slate, more or less dark. 2. A coat of coarse hair. 3. Any evidence of impurity of blood or a cross. 4. Any deformity or malformation.

The following are the characteristics of the Suffolk breed:

Head small, very short; cheeks prominent and full; face dished; snout small and very short; jowl fine; ears short, small, thin, upright, soft, and silky; neck very short and thick, the head appearing almost as if set on front of shoulders; no arching of crest; chest wide and deep—elbows standing out; brisket wide, but not deep; shoulders thick, rather upright, rounding outward from top to elbow; crops wide and full. Sides and flanks—long ribs, well arched out from back, good length between. Shoulders and hams—flank well filled out, and coming well down at ham; back broad, level and straight from crest to tail; no falling off or down at tail; hams wide and full all the way down; legs small and very short, standing wide apart, in sows just keeping belly from the ground; bone fine; feet small, hoofs rather spreading; tail small, long and tapering; skin thin, of a pinkish shade, free from color; hair fine and silky, not too thick; color of hair pale yellowish white, perfectly free from any spots or other color; size small to medium.

The best specimens of the Essex breed may be known by the following scale of points:

Color, black; face, short and dishing; ears, small, soft, and stand erect while young, but coming down somewhat as they get age; carcass, long, broad, straight, and deep; ham, heavy and well let down; bone, fine; carcass, when fat, composed mostly of lard; hair, ordinarily rather thin. The fattening qualities are very superior; as breeders they are very prolific, and are fair nurses.

The points and characteristics of a few other breeds are given, but they are so little known that we do not deem it necessary to quote further from the reports of the various committees.

The committee to whom was referred a resolution to determine as to what characteristics a hog should possess to render it the most profitable to the raiser and consumer, made the following report:

He must have a small, short head, heavy jowl, and thick, short neck; ears small, thin, and tolerably erect, not objectionable if they droop slighty forward; must be straight from the neck back to flank; must be let well down to the knees in brisket; of good length from head to tail; broad on the back; ribbed rather barrel-shaped; must be slightly curved or arched in the back from shoulder to the setting on of tail; tail, small; long in the ham from hock to letting off the loins; shoulder not too large to give symmetry to the animal; ham broad and full; hair, smooth and evenly set on; skin, soft and elastic to the touch; legs, short, small, and well set under; broad between the legs; good depth between bottom and top of the hog; with pleasant, quiet disposition; should not weigh more than 300 to 400 pounds, gross, at twelve to eighteen months old, according to keep; color may be black or white, or a mixture of the two. The above-described hog will measure as many feet from the top of the head to setting on of tail as he does around the body, and will measure as many inches around the leg below the knee as he does feet in length around the body; depth of body will be four-fifths of his height.

A committee appointed to determine a scale of points reported the following, aggregating 100:

1. Back, 10; 2. Long ribs, 8; 3. Short ribs, 7; 4. Shoulders, 8; 5. Ham, 12; 6. Length of body, 6; 7. Flank, 6; 8. Twist, 6; 9. Snout, 4; 10. Jowl, 3; 11. Face, 3; 12. Ear, 2; 13. Neck, 4; 14. Belly, 4; 15. Skin, 5; 16. Hair, 3; 17. Bone, 3; 18. Legs, 3; 19. Feet, 2; 20. Tail, 1.

On the subject of thorough-bred swine the committee report that only such breeds as are recognized in authentic history as of sufficiently remote origin, when bred in a direct line, to result in the establishment of a fixed type, capable of duplicating themselves with uniformity, should be regarded as thorough-breds.

On the classification of breeds of swine at county and State fairs, the committee recommend the adoption of the following plan: Class 1,

Berkshires. Class 2, Poland-China. Class 3, large white breeds, to include Chester Whites, Large Yorkshires, Large Lancashires, Cheshires or Jefferson County, and other similar swine. Class 4, small white breeds, to include Suffolks, Small Yorkshires, Small Lancashires, and other similar swine. Class 5, small black breeds; Essex and Neapolitans. Class 6, cross-breeds, and all not eligible in the other classes.

In accordance with a call issued the preceding year, a national convention of short-horn-cattle breeders assembled at Indianapolis on the fourth Tuesday of May, 1873. The convention was largely attended, delegates being present from the States of Wisconsin, Missouri, Michigan, Massachusetts, Maryland, New York, Ohio, Kentucky, Indiana, and Illinois.

On the first day of the convention Professor Miles, of Michigan, offered the following resolution, defining the various grades of short-horns:

Pure bred, full bred, and thorough-bred, as animals of a distinct and well-defined breed, without any admixture of other blood.

Cross-breed, animals produced by breeding together distinct breeds.

Grades, as the product of a cross between a pure breed and a "native."

High grades, an animal of mixed blood, in which the blood of a pure breed largely predominates.

These definitions were laid on the table for the time being, but were afterward taken up, warmly discussed, and finally passed by a small majority.

After a lengthy discussion on the subject of over-feeding, the following resolution was adopted, as embodying the views of a majority of the convention:

Resolved, That in the estimation of this convention it is not only necessary in successfully breeding short-horn cattle that we should secure animals of fine form, pedigree, &c., but that they should be *well fed* and cared for; at the same time we look upon the practice of keeping up cattle without exercising, and feeding to their utmost capacity, for the purpose of show and sale, as injurious to their health and usefulness as breeders.

A permanent organization was effected by the adoption of a constitution and by-laws, the election of permanent officers, a board of directors, &c. Dr. A. C. Stevenson, of Greencastle, Indiana, was elected as permanent president.

The following recommendations for the better management of the American Herd Book were offered in the shape of resolutions, and after considerable discussion were adopted:

Resolved, That the name and address of both breeder and owner shall be given, together with the date of birth and color of the animal.

Resolved, That the ancestry of animals should be traced on both sides to imported animals, or those heretofore recorded in the American Herd Book with correct pedigrees, before they can be entitled to registry.

Resolved, That family names should belong to the breeder first claiming that name, in some agricultural paper of the United States or Canada, or in previous volumes of the Herd Book.

Resolved, That the person under whose direction the animals are coupled shall be recognized as the breeder of the produce.

A resolution recommending the establishment of an efficient professorship of veterinary practice in each agricultural college, and that said professorship receive a liberal endowment from the college fund, was also adopted.

The convention adjourned to meet in Cincinnati, Ohio, on the first Wednesday in December, 1874.

ILLINOIS.

The annual report of the secretary of the Illinois State board of agriculture for the year 1871 contains, in addition to the business transactions of the board, detailed reports from important committees, essays on "The preparation and management of a fruit farm in Illinois," "Cultivation and preparation of vegetable and garden seeds," "Cultivation of flax and manufacture therefrom," "Manufactures in Illinois," "Planting and cultivation of forest trees," "Principles and plans of landscape gardening," "On the manufacture of soap," &c.; reports from a large number of county organizations; an act relating to the organization of a department of agriculture and defining the duties of the officers of the State board; proceedings of the Illinois State Swine Breeders' Association and debates on the subject of swine breeding and swine rearing.

In accordance with the provisions of an act passed by the legislature and approved April 15, 1871, creating a department of agriculture, the old society was soon thereafter disbanded and its records transferred to the keeping of the new State board created by said act. The old society did much toward the advancement of the agricultural and other productive interests of the State, and in every way deserves the handsome tribute paid it by the new secretary. A condensed history of the society is given, with a brief synopsis of its more important business transactions, commencing with the first meeting held in May, 1853, and closing with the last one held in the same city on the 3d day of January, 1871. Records were in possession of the society showing its existence as far back as 1819, when the State was hardly one year old.

Mr. James H. McConnell, of Sangamon County, has, for two or three years past, been making experiments with Indian mallow, (*Abutilon Avacennæ*,) better known among the farmers of the Western States as "stamp weed," "velvet leaf," "butter print," "button weed," &c. It is indigenous to many of the Northern and Western States, and in some localities is a great pest to farmers. Mr. McConnell has succeeded in obtaining from the plant a surprising quantity of strong fiber, which appears to be suitable for all those purposes for which hemp is now almost exclusively used. Experiments in the manufacture of paper from the fiber have proven highly satisfactory, and it is thought it can also be made to take the place of jute in the manufacture of many articles in which the fiber of that plant is now exclusively used. Ropes manufactured from this fiber were exhibited at the State fair for this year, and attracted much attention. A committee was appointed to examine raw and manufactured specimens of the fiber, and elicit from Mr. McConnell all facts relating to its value as a fiber plant, cost of cultivation, and its value per acre. From the report of this committee we make the following extract:

> We are informed by Mr. McConnell that it will, with the same ground, care, &c. yield from 50 to 100 per cent. more than hemp; that the ground should be plowed deeply in the fall and lightly in the spring, and seed sown at the rate of from 12 to 16 quarts to the acre, in the spring, in good corn-planting time, in the same manner as hemp; that a swath 3 feet wide can be cut with a common reaper, or a wider swath with McCormick's hemp-reaper; that it should be shocked the same as hemp, in the field, till cured, and the first crop water-rotted the same as hemp; after this a second volunteer crop will spring up the last of July, which may be cut and dew-rotted in October. The plants will grow from 9 to 14 feet high. The seeds are separated the same as hemp. The cost of cutting, per acre, is reported to be 75 cents; the cost of water-rotting, $10; cost of dew-rotting, $5; cost of hand-cleaning, $12. The cost of cleaning with machinery is less than half that amount, while the cost of a good machine need not exceed $100 in Philadelphia. This would bring the actual cost of the fiber, beside rent of land, at from $19 to $31 per ton.

The Messrs. McConnell are offering to contract for the fiber at $100 per ton, for all they can get of water-rotted, of good quality, and $75 per ton of dew-rotted. But hemp of the same quality is worth from $250 to $400, which leaves them a bonus of from 100 to 300 per cent. on their patent. The crop is said not to exhaust the land if the refuse is restored to it. The fabrics exhibited were certainly of very fine quality and strength, both in the fiber and the cordage. It receives all sorts of colors, and retains them, it is said, nearly as well as wool. It is, therefore, of great value as a warp for carpets, rugs, and cloths requiring color. It loses 50 per cent. less than hemp, and is of a texture and appearance equal to the best Russian hemp, and about the same strength as Manila in cordage.

Mr. James H. McConnell, who has paid much attention to the cultivation of fiber plants, contributes a valuable paper on the cultivation of flax. He says this plant will do well on a variety of soils, but can only be brought to its fullest perfection in a rich, deep, and moderately moist soil, containing in its composition much vegetable matter. Good corn-lands will generally grow a profitable crop of flax. The land should be deeply plowed and harrowed, and rolled until a very fine tilth is reached. Plowing should take place as early in the spring as the complete departure of frosts will permit, and the seed should be sown immediately after. The seed should be harrowed in well. In order to secure an evenness of vegetation it is advisable to go over the land again with a light roller. The quantity of seed sown should depend upon the object desired. If for fiber, about two bushels of seed, evenly sown, will be required to the acre; but if seed alone are desired, about one-half bushel to the acre will be found sufficient. Care should be taken to select good seed, as the success of the crop will materially depend upon this point. Proper seed for cultivation are bright, smooth, and very slippery, and plump and sufficiently heavy to sink in water. The interior of the seed, when broken open, should present a yellow-greenish appearance, and taste sweet and oily.

As to the time of cutting and the proper mode of preparing the plant for fiber, Mr. McConnell says:

If the finest fiber is desired, the crop should be harvested as soon as the blossoms have fallen off. The plants should be bound in small bundles, and immediately submitted to the water-rotting process. If you contemplate dew-rotting the plants, allow them to stand until nearly ripe. As soon as they are cut down, bind the plants in small bundles, and place them in shocks of convenient size, to cure. When sufficiently cured, stack them well, and allow them to remain until the season for dew-rotting arrives, which is about the middle of October. If seed are desired, allow the crop to stand until ripe, and then treat it substantially in the same manner as oats. Ten bushels of seed and 600 pounds of fiber are good average crops; but frequently as many as 20 bushels of seed are grown per acre on the fertile lands of Illinois.

Alluding to the profits of flax culture, Mr. McConnell states that the farmers of Champaign County last season sold their flax-straw at a price which paid all expenses of raising the crop, and had left for profit from 10 to 15 bushels of seed per acre, which they sold at $2.50 per bushel.

In the course of an article on manufactures in Illinois, Mr. James W. Dwyer alludes as follows to recent efforts in the manufacture of beet-root sugar:

Notwithstanding much had been said and written upon this subject in this country, it appears that no regular or systematic effort to manufacture sugar from the beet had ever been attempted in the United States until the purchase of 2,500 acres of land in Livingston County in this State, and the erection of the sugar-beet factory at Chatsworth by the Messrs. Cheneith Brothers. Not having sufficient capital to fully carry out their designs, they formed a joint-stock company, the stock being mostly taken by parties in Springfield, who embarked in this novel undertaking more from motives of pure State pride and patriotism than from the hope of any large profits. Everything that was called for which money could procure was furnished without stint; but, unfortunately for the company, and still more unfortunately for the agriculture and manu-

facture of sugar in the United States, the undertaking, after many years of experiments, disappointments, and difficulties at Chatsworth, was forever abandoned, and the machinery and apparatus moved to Freeport, where Bunn, Rosensteil & Co. are erecting another factory, and in which, if they are successful in solving the problems of, first, securing a crop of beets grown by the farmers and purchased by the ton, and, secondly, of getting 7 per cent. of sugar of a first-class quality from those beets, the sugar-beet manufacture may be looked on as having got a permanent foot-hold in the State.

A general impression seems to prevail that sugar cannot be made from beets grown in Illinois. This is a mistake.

The sugar made from the last crop of beets was sold in the Chicago market, and was of as good a quality and brought the same price as the same brands of refined cane sugar; and the beets grown at Freeport this past year were pronounced, by experts, as fully equal to the beets grown in any part of Europe in the percentage of the sugar which they gave on strict chemical analysis. The sources of failure arose from other causes, among which was the want, from first to last, of a full supply of water. Coal had also to be transported a long distance at great cost, the supply failing at the most critical times; the need of irrigation in the hot summer season, and the drowning of the plants in wet seasons; the costly and troublesome effort to grow, every season, several hundred acres of beets, instead of purchasing them from the farmers, by the ton. And the greatest difficulty was in securing, at any rate of compensation, skilled employés, practically acquainted with the mechanical wants of the concern, or possessing the requisite skill and practical information demanded for the conversion of the juice of the beet into first-class merchantable sugar.

Next to the manufacture of iron, there is no other undertaking, combining field culture, stock-feeding, and a highly valuable manufactured and profitable article, which can be embarked in by our people, and which holds out such brilliant prospects of success, as that of converting the juice of the beet into sugar. That it can be done in this State, and done with large profit to the farmer and the manufacturer, does not admit of a doubt in the minds of those who have made themselves familiar with its history and cultivation in Europe, and of its failure in this State. In Europe the average yield of the roots, in the district where it is cultivated for sugar, is from 15 to 20 tons to the acre. The yield of first-class sugar is 7 per cent., or 280 pounds to the acre, of 20 tons of roots. Allowing that our crops in Illinois yield only 10 tons of beets to the acre, this would give, at 7 per cent. of a yield, 140 pounds to the ton, which would net in market, at present, at 15 cents the pound, $21 to the ton, or $210 to the acre; and as a factory would work up 50 tons of roots each day, the value of the daily work would be $1,050. At these figures the factory could very readily pay $5 a ton, which would leave a balance in favor of the factory of $800 on each day's work of 50 tons; or, at $10 the ton, it would leave a daily balance of $550, or a margin sufficient to cover all the expenses of manufacturing such as the manufacture of on other commodity can exhibit.

After contrasting the difference in the profits of sugar-beets at from $75 to $100 per acre, and corn at 30 cents per bushel, or $9 per acre, Mr. Dwyer closes his reference to this promising new industry as follows:

The present effort to establish this interest at Freeport should be regarded as highly praiseworthy, but it must be confessed that a failure would be almost fatal, for the next twenty-five years, to the sugar-beet business in this State, and for this reason other experiments should be tried, and that extensively, in different parts of the State, so as to make a test of the soil, climate, yield per acre, and percentage of sugar. Were the State of Illinois part of the dominions of the King of Prussia, there is not a county in the State but would have been tested as to capability for producing sugar from the beet; and long ere the present day the smoke ascending from the chimneys of hundreds of sugar-beet factories would be visible all over the State, retaining more wealth, now expended by us for foreign sugars and establishing an outside trade, than any other agricultural interest can ever hope to do, because of the ability of sugar, from its great compactness, to submit to a rate of freights that would be impracticable with our grains, meats, and other bulky products.

There has been some objection to the European larch, and its cultivation in artificial forests has been discouraged, but it is highly commended for various reasons in a paper contributed by Mr. H. J. Dunlap. This gentleman says:

No tree excels the European larch in rapidity of growth, strength, and durability. I need not recount the many other uses to which this wood is adapted, but will consider it merely as a wind-break, for vineyard stakes, posts, and ties. As a grower, the tree is upright, symmetrical, and strong. Two-year old plants I consider best for planting.

At that age they average 1 foot in height, and at six years from planting will be from 8 to 10 feet high, and 2 to 4 inches in diameter; provided, always, that the same culture is given them that is given to corn. At this age the trees may be thinned to 4 feet apart. They do not require further cultivation, their dense growth so shading the ground that weeds cannot grow. At ten or twelve years from planting, a majority of these trees will make good fence-posts, more durable than any other wood.

Mr. Dunlap regards the osage orange as next in value to the larch, both as to rapidity of growth and durability, when properly cultivated and grown to sufficient size. When grown for stakes, posts, and ties, the trees should be planted about 20 inches apart in the row, and the rows 4 feet apart. An annual pruning must be given to induce the trees to run up, and prevent the wasting of its strength in side branches. At six years these trees will make vineyard-stakes, handspikes, &c., and should be thinned out one-half. When given sufficient room the tree grows very fast, and but a few years will be required for it to grow large enough for posts. The wood, when seasoned, is very tough, and answers admirably for mallets, buts, hubs, wagon-axles, &c. No insects prey upon the young plants, and it makes a large and very fine ornamental tree. He regards the yellow locust as objectionable, because of the depredations of the borer, which has destroyed most of the young forests of the State.

Mr. Dunlap gives the following directions for planting nut-bearing trees:

The seed of all nut-bearing trees should be planted in autumn, in ground well prepared with the plow and harrow. Furrow out the ground with a small plow, in a similar manner as for potatoes. Drop the nuts at suitable distances apart, say 1 or 2 feet, for these trees must remain where the seed is planted, as none of them transplant readily. Acorns, hickory, and chestnuts should be planted as soon as they fall; a few days' drying injures their germinating qualities; cover 2 inches deep, and mulch the rows with straw. Walnuts, both white and black, may be covered 3 inches, and should also be mulched. These trees all require dry soil; it is useless to plant on wet land. The young plants should be kept free of weeds for two or three years; after that they can take care of themselves.

Mr. James W. Dwyer contributes an article on the manufacture of soap. He gives the following process for the manufacture of hard soaps:

After the raw soda or barilla is ground or pounded, it is placed in a vat in alternate layers with unslacked lime, the bottom layer being lime. Water is allowed to infiltrate through those layers, and the lye is secured as it trickles through a hole in the bottom of the vat. The lime absorbs the carbonic acid of the soda, making the lye caustic or fit for the soap-kettle; and the quantity of lime applied must be in proportion to the quantity of carbonic acid in the soda. * * * To every 20 pounds of tallow add one gallon of weak lye, and boil until the lye is spent. The mass must then cool for one hour, the spent lye drawn off, and another gallon of strong lye added; the mixture again boiled until the second dose of lye is spent; and the same process must be repeated for several days, until the mixture, if properly managed, is converted into white tallow soap, which should be allowed to cool gradually and settle, when it is poured into molds, and when solid it is cut into the bars which are found in our markets. Twenty pounds of tallow ought to make 30 pounds of first-quality hard soap, allowing three pounds of soda-ash for every 20 pounds of tallow. The balance of the weight is made up by the large quantity of water which enters into combination with the grease and alkali in the course of saponification.

When yellow or resin soap is required, the hard soap has to be made in the usual manner, and at the last charge of lye, or when the soapy mass ceases to absorb any more lye, one-third the weight of pounded resin is introduced, the mixture constantly stirred, and the boil kept up vigorously until the resin has become incorporated with the soap. The whole must stand until it settles, and the soap then dipped out. Resin soap, when well made, should be a fine, bright color.

The writer then gives the following directions for making soft or potash soap:

The principal difference between hard and soft soaps is, that three parts of fat afford, in general, fully five parts of hard soda-soap; but three parts of fat or oil will

afford six or seven parts of potash-soap of a moderate consistence. From its cheapness, strength, and superior solubility, potash-soap is preferred for many purposes, particularly for the scouring of woolens.

The lyes prepared for making soft soaps should be made very strong, and of two densities, as the process of making potash or soft soap differs materially from that of making soda or hard soap. A portion of the oil or fat being placed in the boiling-pan and heated to near the boiling-point of water, a certain portion of the weaker lye is introduced and the fire kept up so as to bring the mixture to the boiling-point; then some more oil and lye are introduced alternately, until the pan is filled. The boiling is continued gently, strong lye being added until the saponification is complete. The fire should then be removed, and some good soap, previously made, added while cooling down, to prevent any change by evaporation. One pound of oil requires about one-third of a pound of American potash, and will make one and three-quarters to two pounds of well-boiled soap, containing about 40 per cent. of water. Sixty pounds of lard will make 100 pounds of first-class soft-soap by using one and a half cans of concentrated lye, which is made from salt, and is really a soda-lye.

The first annual meeting of the State swine breeders' association met in Springfield on the 3d day of January, 1870, and held a two days' session. The meeting was well attended, and a lively interest seemed to be taken in the discussion of all subjects relating to swine-breeding and pork-raising. A committee on statistics was appointed to collect such information as might be thought useful in the advancement of the interests and the protection of the breeders of swine and pork-raisers of the State. Much general information was obtained by those present from public and private discussions upon the subject of feeding, breeding, erection of proper buildings, and the management of hogs. The following is a synopsis of the general points discussed:

1st. It was the universal opinion that during the season of low prices, a greater exertion should be put forth to improve the quality of stock, as the very best means through which to realize a profit. For illustration: Take pork at $5 per hundred-weight, as the standard. If the price shall depreciate 10 or 20 per cent. annually from this, should we improve the quality of animals 10 or 20 per cent., we still receive $5 per hundred-weight for the product; but if the price should advance in the same proportion, it would give a much larger profit.

2d. It was the general conviction that the breeding of all the various breeds of swine having distinction should be encouraged, as deterioration would most likely follow if confined to but one or two of the most popular.

3d. The best mode of treating sows after farrowing was believed to be to give them food that would create a supply of milk for the young. Immediately after farrowing but little food should be given, except some simple drink, and for several days thereafter judgment should be used in feeding, giving food in moderate quantities until the pigs are a week old, when a more liberal amount may be given. Young pigs should be taught to eat as soon as possible.

4th. Young pigs, after weaning, should have the best care, and the best food should be given them. Milk, sweet or sour, with a little meal, or oats and corn ground together, will be found excellent, if properly fed, and the young pigs allowed plenty of exercise.

5th. It was believed that more profit could be realized by turning pigs into market at the age of from nine to fourteen months, than at any other age.

6th. The plan of feeding best calculated to realize the greatest profit would depend upon circumstances. First, the price of grain; second, the expense of grinding; third, the cost of feed. If the two latter requirements can be cheaply done, it may be made a source of profit. If too expensive, shelled and soaked corn will pay much better than to feed

corn in the ear. Ground and cooked feed will make more pork for the amount of corn consumed than if fed in its raw state, or in the ear.

7th. Upon the subject of disease among hogs, and its cure, but little interest was manifested, although reports came in of the prevalence of disease and destruction of many hogs during the year.

IOWA.

The report of the secretary of the Iowa State Agricultural Society for the year 1871 contains a vast amount of statistical information, showing the progress of agricultural and other productive industries of the State, the business transactions of the society, the list of premiums offered and awarded at the State fair for this year, reports from various committees and special experimenters, besides essays on dairying, fencing in Iowa, feeding hogs, on farm stock, draining, cheese-making, &c. There are also appended to the report the proceedings of the second annual meeting of the Iowa Bee-keepers' Association, and the proceedings of the Eastern Iowa Horticultural Society.

The report shows, first, an increase of the average of the cereals, with improved quality and increased quantity of corn, wheat, oats, and barley; second, marked improvement in farm stock, and a perceptibly growing attention to sheep; third, greater success and faith in the culture of sorghum; fourth, a gratifying tendency to a more varied system of husbandry; fifth, more systematic utilization of fertilizers; sixth, an improvement in the varieties, and the best crop of tame grasses harvested for several years; and, seventh, a marked degree of advancement in all the departments of taste and refinement, exhibited in fruits, flowers, and the ornamentation of farms and homes.

The corn crop for this year was enormous. Estimating the area cultivated at 2,500,000 acres, or nearly one-fourth of all the land in cultivation in the State, and the yield at 40 bushels per acre, and the entire product will be 100,000,000 bushels. This increase in the production of corn brought with it a proportionate increase in hogs, cattle, and other farm stock, the greatest increase, however, being observable in the increased number and quality of hogs.

There has also been a large increase in the number of sheep reared and pounds of wool produced. Taking the returns of the last census as a basis, the secretary estimates the number of sheep within the State at one and a half millions, and the shipments of wool at nearly or quite 5,000,000 of pounds. The shipments from ascertained sources reached 3,074,674 pounds. As in many other States, dogs continue their depredations, and many valuable flocks are continually being decimated by their nocturnal visits. In 1854 the number of dogs within the State was given at 86,060; in 1860 the number had increased to 125,207, and in 1868 to 147,623. The number has greatly increased since and is now estimated at 170,256. Laws passed with a view to their extermination, by the imposition of a heavy tax, remain unexecuted.

Increasing interest is manifested in the cultivation of sorghum. Thirty-four counties report a crop averaging from 100 to 300 gallons per acre. The yield of syrup from the crop of 1870 was 2,979,480 gallons, and that of sugar 16,500 pounds. The yield of syrup for this year, based upon returns already received, is estimated at 3,500,500 gallons, with a corresponding increase in the production of sugar. Mr. William Smay, of Story County, was awarded a premium by the society for the largest yield of syrup per acre. He planted one acre and forty-four rods of the Otaheitan variety, and one hundred and forty-four rods of

the White Imphee. Of the latter he raised at the rate of 305 gallons of syrup to the acre. The cost of cultivation and manufacture was $70. The syrup being valued at 50 cents per gallon, left him a net profit of $82.50 per acre. The following is Mr. Smay's system of planting and cultivating sorghum:

1. One of the most important things is to select a suitable piece of ground, as all soils will not produce good sorghum. It should be dry land; a light sandy soil will produce much the best syrup. During the last six years I have made upwards of 9,000 gallons. In working cane that has been raised by different persons and on different soils, I have always made the best syrup from cane that was grown on a warm sandy soil. Last fall I had a fair test: two of my neighbors planted cane; each used the same seed; one of them had a dry farm and the other had a flat wet farm, with a cold soil, a soil that some of our farmers call blue ruin. These two men cut and hauled their cane at the same time. I first tried that grown on the wet land. The yield of sap was good; it also boiled nicely until it began to thicken, then it darkened and smelled very unpleasantly. We tried it in different ways, but the syrup continued dark, and, worst of all, the syrup had an unpleasant taste. We called it worthless and stopped grinding and commenced on the other man's, and with the same work made very good syrup. We gave the other a second trial, but with no better result.

2. There is not much difference as to when the ground is plowed for cane. Last year I tried both fall and spring plowing but could not see any difference in the cane. The main thing is to plow deep and harrow well, so as to get the ground mellow, as cane-ground should be in good condition so as to bear early cultivation.

3. Plant as early as possible, if the conditions will allow, about one week before you plant corn. There is no danger of good seed rotting in the ground if planted early. I have always made the fairest and best flavored syrup from cane that was planted in drills. I find that drilled cane, planted about three feet eight inches apart, is best; it makes but little difference whether the cane is drilled continuously or grown in hills eighteen inches apart.

4. One of the most important rules is to *cultivate early and often.* Cane, while small, will bear any kind of rough handling better than neglect; therefore the hoe and plow should be used with great freedom; but when it gets to be 10 or 12 inches high it should not be cultivated *deep,* as the roots extend from one row to the other and take up every inch of the ground. At this stage the weeds should be cut off with a hoe or pulled up. With regard to thinning out or removing suckers for a permanent stand, this must be regulated by the quality of the land. If the land is rich and strong, such as would produce 50 or 60 bushels of corn to the acre, it will do to leave from three to four stalks to every running foot; if planted in rows both ways, allow from six to eight stalks to stand in each hill. It is better to thin while small, so as not to disturb the roots of that left standing. It will do but little good to cut them off with a hoe—they don't mind that much.

5. In harvesting, never allow the cane to stand in the field after it is stripped. This will injure it more than any other thing. It is contrary to nature, and either drives the sap to the roots or causes it to run out at the joints and bruises from blading. If allowed to stand many days the sap which runs from the stalk ferments, and causes the syrup to be dark and gives it an unpleasant taste. My method of stripping is to use a long, flat stick, made in the shape of a sword; a lath will do very well. It is much easier stripped with a stick than with the hands. In two or three strokes nearly every blade can be knocked off a hill. The dead blades on the butts of the stalks should be carefully taken off, as they are very dirty and color the syrup.

6. The plan of my furnace is one main furnace with two pans, and a small side furnace to finish off on the back pan, being ten feet long and the front one five feet; the side pans are five, and each of them two and a half feet wide. The juice is conducted from the mill to the pan by a lead trough running in at the back end of the long pan, and passing from that through a faucet into the front pan, thence into the side furnace, where it is boiled to its proper thickness. The fire passes from the side from under the front end of the long pan. This furnace worked well; the back pan worked like a charm. The juice ran in at the back end continually, and the heat from both of the fires passing under it, it boiled over half of the way back in a continual foam, working all the scum to the back end, where it could be easily removed. The back pan did its work so well that there was scarcely any skimming to be done on the front pan, while, in the front pan, it boils very rapidly, and when boiled to the proper stage it is run off into the side pan, where it is finished over a slow fire, and in this way can be boiled to any thickness you may wish, without danger of scorching it.

As early as January a very fatal disease attacked the hogs in the neighborhood of Davenport. The epidemic spread rapidly, and by November had passed over the counties of Appanoose, Clarke, Madison,

Marion, Page, Tama, Washington, Jefferson, Black Hawk, Lee, Wayne, Frémont, Dallas, Jasper, Bremer, Lucas, and other counties. In some counties the first symptoms of the disease manifested themselves by causing extreme drowsiness, followed by severe convulsions. In others the disease commenced with staggering, followed by the inside of the ears and legs turning purple. Thousands of hogs perished; in some sections the loss was at least 35 per cent., while in others it was still greater, not one in fifty recovering. No remedy for the disease was discovered.

Mr. C. D. Beeman, contributes a paper on the feeding of hogs, from which the following extract is made:

Indian corn is and must remain the chief food for making pork. Should it be ground? The whole average cost of grinding to Iowa farmers, including time and team, would doubtless amount to the value of one-fourth of the grain. Then, will four bushels of unground corn make more pork than three bushels of ground? Yes, if cooked. And now I desire to give you a plan for properly cooking corn, which is by so cheap a method that it is within the reach of every farmer in the land. Procure a pine plank 2 feet wide, cut off two pieces 7 feet long each, for the sides of a box; two pieces more are now required, each 28 inches long and 20 inches wide, for the ends; bevel the lower side of the end pieces (at an angle of forty-five or more degrees) to an edge; nail the ends on the side pieces even at the top. Now we have a box, except it has no bottom; nor are the ends covered, lacking 4 inches on each, but a sheet of Russia iron 8 feet long and 28 inches wide will complete it. Nail it on with two rows of three-penny nails, but where the iron laps on the beveled edge of the end boards, put in around the corners a few six-penny nails to prevent breaking the iron in turning a square corner. The iron reaching part way up on each end is to prevent burning away the wood. That the bottom may not sag, put across two bars of one and a half by half inch iron, dividing it into three spaces of 2⅛ feet each.

Such a box will hold 24 bushels, but 8 bushels of dry corn will swell to fill it when cooked. It will not leak (if nailed strong with long nails) even if the end pieces are nailed on rough. The outside should be dressed and painted to prevent checking in dry weather. A low brick or stone furnace, 22 inches wide inside, with door front and grate, should be built, and the tank above described set upon it. Put as much water as the grain you intend to cook will soak up in cooking, (an inexperienced person will never put in water enough at first,) and when it is heated to the boiling point close up the draught, put the grain into the water, and put a board cover over the top. Now, the cover, sides, and ends, being mostly of wood, and at the bottom a hot furnace, heat will not escape, and it will cook most thoroughly without any more fire. The above-described tank is of sufficient size for twenty-five or thirty hogs. For more hogs increase the size or make additional tanks. The benefits of cooked food are twofold. First, the grain is all digested and nothing lost. Second, the risk of overfeeding is reduced to almost nothing, the same amount being of three times the bulk, the stomach is filled before the hog gets too much. We are always anxious to fatten our hogs as fast as possible, and in feeding dry grain are apt to feed too much, (which is worse than throwing the corn away,) so that the hog overloads his stomach and it becomes diseased, consequently we continually hear the complaint among farmers that their hogs are not doing well. If the hog leaves his feed and lays down before it is all eaten, he has been fed too much. Take what is left away, and in future feed less. My own method has been to cook grain without grinding, as above directed, and let it stand until it soured a little. Then fed it has been attended with excellent results. * * * Charcoal and ashes should always be within reach of hogs. A little salt is also beneficial. If a hog becomes constipated, feed nothing but wheat bran mixed with slop from the house, and it will soon be corrected. To make pork cheapest, feed liberally from a pig to the day of butchering.

In the course of an article on hedge-fences, Mr. M. W. Robinson gives his preference to the Osage orange. He attributes a large majority of the failures with this fence to a lack of knowledge of the habits and requirements of the plant and inexperience in its cultivation. When planted in dry land, and given proper care and attention, a number one fence can be made complete in from three to four years, at a cost, including everything, of from 50 to 75 cents per rod when turned out.

The native honey locust, which is found growing in every section of the State, he regards as the next best plant for a hedge. From expe-

riments he is satisfied that this hedge can be made a complete success. His plan for preparing the seed for planting is as follows:

Gather them in the fall when fully ripe and commence to fall of their own accord, shell and store them in a cool, airy place, to insure them not to mold. In the spring in good weather, and, at the time of planting corn, put them in a bowl or crock, and pour boiling water on them until the seed are covered, and let them stand in a cool-place eight or ten hours; then pour off this water and put on boiling water as before. After standing from four to six hours drain off the water again, and they are ready immediately to plant in the ground, which must have been well prepared by plowing up into a ridge where the fence is designed to be. Then mark off a straight shallow furrow, and drop two or three seeds in a place, 18 or 20 inches apart; cover one or two inches deep, owing to the weather. They will be up in four or five days; cultivate as corn, and if necessary use the hoe to clear them of weeds. If all have come up well they can be dug up in the fall and saved, except one in a place, and those that have been kept through the winter can be planted in the spring the same as the Osage orange, only earlier in the season. If any have missed growing, be sure and fill the space with a strong, vigorous plant; cultivate the second year the same as the first. By having the plants the distance designated enables them to throw out a considerable number of side branches, which are essential and should not be cut off. At two or three years old they may or may not be cut and plashed down as Osage orange; if not cut down, they should be top trimmed, so as to keep the side branches alive and thrifty, which insures a growth of thorns on the side branches, and renders it stock-proof.

The secretary alludes to the fact that the society has offered a premium of $1,000 for the best 10 acres of timber grown within the State, payable in 1881, and urges upon the legislature the importance of offering a direct bounty in cash to the cultivator of a given area of artificial timber. He thinks that a few years would so thoroughly satisfy every one of the benefits and profits of arboriculture that bounties would not be needed as a stimulus. One person in Appanoose County is reported as having planted 30,000 forest trees, and another one in Lyon County 250,000. *Per contra*, Osceola County, containing 276,480 acres, is represented as not containing a single forest-tree. In Monona County maple trees were grown from the seed, in seven years, large enough to make three 10-foot rails each, with 4,000 trees to the acre. Larch will grow much taller and nearly as large in the same period. In Monona County they have been grown 35 inches in circumference, 18 inches from the ground, in eight years from planting. In his address at the annual fair of this year President E. R. Shankland thus alludes to the importance of forest culture:

There is another important interest not yet sufficiently appreciated—that of forest culture. Such is the practical necessity and value of forest products, that about one-sixth of the land in any agricultural country should be occupied by a variety of forest trees. Yet Iowa, as a State, has scarcely a twentieth part so occupied. Only a few counties have native forests enough, and some are nearly destitute of timber. In many counties the young groves of artificial planting have become more valuable by the acre than any other land. Twenty years of experience have proved that at least twenty kinds of native trees may be made a more profitable crop than anything else that can be grown on the same ground.

A great loss of bees is reported during the winter of 1871–'72. From reports received and statistics gathered by Mrs. E. S. Tupper, she estimates that at least two-fifths of the whole number in the State have died. After a patient and thorough investigation of the matter, she states that the loss of bees is attributable, not so much to the extreme and prolonged cold weather, as to the condition in which this severe cold found the stocks. She says:

The dry weather of last season checked the rearing of brood early, so that colonies universally went into the fall weak in numbers compared with ordinary years. Then the honey-harvest through the autumn was unusually good, and the bees gathered it late. In most seasons an early frost checks the flow of honey, and two months or more of pleasant weather succeeds, in which the bees live on their stores and *eat away the honey from the center combs*, so that when freezing weather comes, they have

empty space in which to cluster comfortably. This year cold weather came before they had consumed honey in any quantity, and found small clusters resting on sealed honey instead of empty comb. In this condition they would freeze, precisely as if they had been on cakes of ice. Some report their bees as dying of dysentery. I have examined many such cases. The appearance of dysentery is simply the natural discharge of fecal matter which bees retain all winter, if comfortable, but when cold they have no power to do this, but void it over the combs, adding greatly to their discomfort.

The question now arises as to the remedy which, in the prevailing state of things, might have saved the bees last fall. If the hives, full of honey and weak in numbers though they were, had been put where it did not freeze, in a cellar or house, they would all have wintered safely and been stronger in numbers in the spring than when put away in the fall; or, if several combs had been emptied by the use of the honey slinger before extreme cold weather, and the hives left out of doors well packed in straw or chaff, all not very weak in numbers would have done well. In every case we have examined or heard from, a few minutes' attention at the right time would have saved the bees, and in view of this fact the loss is indeed deplorable. It is quite time that bee-keepers realized the fact that though their colonies do not require much care, still a little attention at the right time is indispensable. In movable-comb hives an examination of their state can be made at any time and the remedy applied. * * * * Let all bear in mind that all colonies are safer housed every winter, and that those which are weak in numbers, if left in combs full of honey, must die if exposed to hard frost.

MICHIGAN.

The merit of the annual report for 1871 is considerable, not alone on account of its local statistics, but with regard also to its excellent articles on subjects of current importance. Several are chosen from other than local sources, but are freighted with information valuable to the farming community. A very elaborate statement is made concerning the condition of the State Agricultural College, showing great prosperity. The whole number of students in actual attendance during the year was 141. It is stated that the students, for several years past, have been mostly sons of farmers, and, for the most part, largely dependent on their own earnings for the means of securing an education. The whole amount paid students for their labor on the college farm was $5,462.32. The success of the institution is of the most flattering character, indicating most certainly the greater interest being taken in the matter of agricultural education in the State.

There is an excellent article on "Grasses for the dairy," by Professor Deal, treating at length upon the subject. The professor is of the opinion that foreign plants are often more thrifty than native, and that we may expect desirable specimens from other countries. No grass is best for all purposes, any more than one kind of apple is best, or one breed of cattle or sheep or poultry. He adds: "You ought to like the business you have chosen, and have a taste for it. While others go from raising sheep, and then back again to cows, or from the dairy to fruit-growing, and back again, keep the even tenor of your way, and stick to your trade." He refers to the fact, illustrative of the value of grass cultivation, that in 1870 the hay-crop of Illinois was valued at over $20,000,000; wheat, over $25,000,000; Indian corn, over $70,000,000; rye, oats, barley, buckwheat, potatoes, tobacco, over $21,000,000; the hay produced by the grasses proper, probably $15,000,000; grasses for pasture, perhaps $15,000,000 more. The valuation of the hay-crop of Illinois was far exceeded by that of New York, which is given at over $77,000,000. In the United States, during the year 1870, the hay-crop was valued at about $330,000,000, and the hay and pasture in the entire Union could have not been less than $500,000,000.

Mr. Hathaway, in his article on "Orchards and their management," thinks that it is getting to be pretty well understood in the Northwest that a great many of the failures by winter-killing of fruit-trees is due

to their having been propagated on tender roots. He makes this statement, which is worthy of consideration:

The fact that the pear on the quince is a failure throughout the West, where the pear has not thrown out roots of its own, is a significant fact, and goes to show the necessity of hardy roots, no less than hardy tops to our trees; and those nursery-men of the open prairie country of the West and Northwest who first recognize the importance of a perfectly hardy stock, and that will intelligently set themselves to work to supply this great desideratum, though at a present disadvantage, perhaps, from the competition of cheap trees, will ultimately reap a just reward, and at the same time prove themselves public benefactors.

In regard to the variety of apple best adapted to the region of Michigan, Mr. Hathaway very strongly recommends the Spy. He has thirteen trees of this kind that were planted at one year old, about two feet high. They stood thirteen years, and had not borne a bushel to the tree, when they yielded an average of 10 bushels, or more. He has found trees of four years' growth safer to transplant than those of two years, under the same circumstances. The wood is more firm, and there is more substance of both roots and top to withstand the vicissitudes incident to the transplanting.

There is a valuable paper from the pen of the late Sanford Howard, on the principles of form required to adapt the horse to special purposes; noticing breeds, &c. A special conclusion of Mr. Howard was that, "in general, and especially for racers, roadsters, and draught-horses, it is better to keep the varieties distinct, breeding each in reference to an ideal or standard, combining the points which, according to mechanical principles and practical observation, denote the highest adaptation to their different purposes. If experiments are made in crossing different breeds, they should be made with caution, and in such a manner as not to hazard a loss of the valuable properties already possessed by a breed."

Mr. J. E. Day, referring to the cultivated acreage of the State in 1870, and the agricultural products accruing, and calling attention to the fact that the average production is lower than that of the eastern states, and of all the middle states save one, draws two inferences—that the shallowculture of the West does not bring up the average with the more thorough management of the East; and that, if Western farmers would raise their average value of crops, or even hold their own, they must discard their own methods and adopt those of the East, cultivating less land but more thoroughly. There were 4,652,500 domestic animals in the State, worth $60,913,608, and one year's crop was worth as much as all the animals in the State, lacking $7,381,968. The highest value of any crop was that of tobacco, $190 per acre. Number of acres so employed, 2,695. Mr. Day thinks that the fruit yield of the State will soon be as large as that of any other State—especially of apples, to the cultivation of which the climate and soil seem peculiarly adapted. He says:

Upon our western coast, land, which until a few years past has been thought to be worthless for all purposes of agriculture, now sells at from $200 to $600 per acre for the purpose of raising peaches and small fruits. Within the radius of three miles of the village of Fruitport, there have been 60,000 peach-trees set out during the last four years, and other fruits in proportion. * * * The soil is of that character known as sand-barrens.

The report proper closes with a full account of the proceedings of a convention held in Chicago, Illinois, August 24 and 25, 1871, convened chiefly through the efforts of W. C. Flagg, of the Illinois Industrial University, and Dr. M. Miles, professor of agriculture in the Michigan Agricultural College, the object being the consideration of the experi-

ments that it would be desirable to conduct similarly, by the different institutions of agriculture, and also the best methods of conducting them. These questions and their ramifications were discussed at great length and with minuteness by some of the leading agricultural educators and experimenters of the country. In view of the great value and importance of experimentation with reference to raising the standard of the products of the farm and the breeds of domestic animals, it was deemed especially advisable that agricultural colleges conduct the same experiments on a uniform plan. It was thought by one speaker that experiments that would lead to valuable results are just beginning properly to be made in this country—there should be an attempt at the explication of established agricultural laws—knowledge of which, positive or proximate, can only be reached by experiments long continued and scientifically conducted. It was thought to be a matter of regret that farmers so rarely co-operate in these efforts, and display so much impatience for immediate results, in many cases distrusting those already attained.

Field experiments should be made on plats of definite size. The object of the experiment should be the discovery of laws in agriculture, not the mere gratification of curiosity. Touching this point, Dr. Gregory related his observations at Munich, Bavaria, at one of the experimental stations:

> I saw some plats, less than those recommended here, in which not only the seeds, even when they were grass-seeds, were measured, but they were carefully weighed and counted, and at the head of every plat was placed the number of seeds. * * * * * Every result obtained from that growth was weighed, root, branch, and fruit. * * * Science in agriculture can make progress no better than in any other branch, unless it comes down to measure, and weight, and count, and applies mathematics to get precise results, and measures and weighs, as far as possible, all the forces that enter into it.

Experiment is useless unless carried on from year to year, closely observing the conditions promoting success or causing failure.

In relation to feeding animals with regard to testing the relative value of different kinds as to healthful properties or fitness for fattening, Dr. Miles recommended that each animal should be placed in a separate pen, and that all should be not only of the same age, but, as near as possible, of the same size, and of the same degree of fatness. He would then confine them to a single article of food. It would be important to test the value of corn-meal, and corn prepared in different ways. He suggests that for feed-experiments he would simply, for animals, try to ascertain the value of Indian corn in its various forms; afterward test other grains, and subsequently the grasses. He thought it desirable to experiment concerning the effects of alternation on the growing crops, and refers to a system which has been tried; wheat having been grown for quite a number of years in succession, and a yield of from 30 to 40 bushels obtained, without any manure.

The system is as follows:

> The field is divided into strips of three feet in width. The wheat is sown on the alternate strips. The vacant strips are kept thoroughly pulverized during the season, and the next year the wheat is put on the strips left bare the year before.

The reports of county agricultural societies show substantial prosperity, and, on the part of these coadjutors of agricultural education, an increasing interest.

The annual report of the Michigan Pomological Society for the year 1871 contains the proceedings of various meetings of the society, the list of premiums offered and awards made at its second annual fair, held at Grand Rapids in September, 1871, an elaborate address by the

president of the society, articles on grafting, grape-culture, wine-making, profits of fruit-culture, snout-beetles injurious to fruits, report of the delegates to the meeting of the American Pomological Society, reports and essays from county societies, the climate, soil, and meteorology of Michigan, &c.

The second annual fair of the society was very successful. The attendance was large, and the display of fruits very encouraging and satisfactory. There were six hundred and four entries. Wayne County was awarded the first and Kent the second premium. The former exhibited one hundred and fifty-eight varieties of apples, twenty-seven varieties of native and fifteen of foreign grapes, besides some other varieties of fruit, such as peaches, pears, quinces, &c. Kent County exhibited one hundred and twenty-five varieties of apples, sixteen of pears, fourteen of peaches, a fine collection of canned fruits, and some large specimens of Black Hamburg and White Fontainebleau (foreign) grapes, raised in the city of Grand Rapids. Of foreign fruits California contributed the following named varieties: seventeen varieties of grapes, among them specimens of the Muscat; a single cluster of Flann Tokay, weighing four pounds; twenty-six varieties of apples, which included Rhode Island Greenings, 14 inches in circumference; Fall Pippins, 13½ inches; Yellow Belleflowers, 12 inches; English Russets, 10 inches; Baldwins, 13 inches; Rambos, 13 inches. There were also seven varieties of pears from this State, some of them weighing as high as one pound and measuring 12 inches in circumference.

The president of the society, Mr. J. P. Thompson, in his address, urges the importance of a more diversified system of agriculture on the part of the people of this State. Twenty-one years ago, when he first became acquainted with the heavy-timbered lands of wheat-growing Michigan, that grain was selling in the interior towns at 75 cents per bushel; in 1852 it brought 90 cents; in 1853, $1.25, and in 1854 it receded to 80 cents; in 1858 it reached $1, and in 1861 it went up to $1.10. During the war it ruled at somewhat higher rates, but the average normal price of wheat for the last twenty years has not been over $1 per bushel. At this rate, if wheat-growing was the only branch of western husbandry, the country would soon be poverty-stricken. The speaker contends that Michigan cannot long compete with California and the great wheat-growing country now developing west of the Mississippi and north of the Missouri Rivers, and says there is an absolute and imperative necessity for the organization of new industries. He says:

> The old agriculture of Michigan, to save itself from ruin, must turn to new sources of wealth; must seek new branches of husbandry; must learn lessons of political economy from her more immediate and older neighbors, Ohio, Indiana, and Illinois. The State of New York relinquished wheat-growing because she found it profitable and necessary to do so. The productions of butter and cheese, the dairy products of that great State, have greatly grown in importance. There has been the same change in Ohio. Illinois and Indiana are the successful producers of stock, and the history of Michigan for the last year shows that the production of wool, and the export of beef and pork now going on, and the product of her dairies, have brought more money to her farmers than her wheat crops, valuable though they have been. It is this diversified husbandry, which will prove her wealth and salvation, that we wish to encourage; and as a permanent industry, a perpetual source of revenue, we take an interest in fruit-culture. * * * There are many things to encourage the fruit-culturists of Michigan, but chiefly I wish to note her market facilities. A State surrounded with lake ports and harbors, she offers peculiar advantages for the shipment of fruit. Across her borders there will soon be five gigantic trunk-lines of railroad, connecting the east and west lakes, and traversing the finest fruit sections of the State. Very soon each and all of her lake towns will be connected with the great centers of western trade by regular daily lines of steam craft, especially adapted to the transportation of fruit, which can be best carried on the water. For all time to come, Chicago will get a supply of fruit from Saint Joseph and Grand Haven.

Alluding to Milwaukee as a fruit-depot, an article is quoted from the Sentinel, of that city, stating that the receipts of green apples at this port during the present year have exceeded double that of any previous year. One fruit-house received the unprecedented number of 22,314 barrels of apples, principally from growers in New York and Michigan, and forwarded them on orders to Iowa, Minnesota, and Wisconsin.

In an essay on grafting, Mr. Benjamin Hathaway states that the vigor of the graft is greatly dependent upon the vigor of the stock. He has ten trees of root-graft Northern Spy, on which the fruit is always very nearly alike as to size and color, except what results from the amount of fruit on a tree; while on forty trees, of the same variety, put on large seedling stocks, the variation is marked and constant. That is, some trees give more highly-colored fruit than others, and do so from year to year, without regard to amount of crop, and the same variation is found in size and quality. His Northern Spy on Rhode Island Greening gives him his largest specimens, though of a pale color. Two trees, close by, grown on Esopus Spitzenberg, always give fruit highly colored, but not so large. He advocates the propriety of propagating a uniform class of stocks, to be grown from some one of our most hardy varieties, and of quality that is unexceptionable.

In a discussion before the society, on grape-culture, Mr. Mason L. Shofer stated that the Concord, Delaware, and Clinton were the only varieties that should be recommended for general cultivation in this latitude. In an address on the same subject, Mr. Edward Bradfield recommends the following varieties: for hardiness, the Iona, Delaware, Catawba, and Concord; for productiveness, the Clinton, Delaware, Concord, Hartford, Iona, and Union Village. All grapes do better if protected in winter. Mr. J. G. Ramsdell states that strong, healthy, one-year-old vines are the best to plant—that where the vines are what they should be when received from the grower, and are carefully and properly attended, an abundance of fruit may be had the third year after planting.

Mr. H. G. Wells gives the following history of the "Kalamazoo" grape:

> This grape, named *here* by Mr. Davis the "Kalamazoo," I brought, some ten years since, from the city of Steubenville, Ohio. There I found it in possession of Mr. Dixon, an Englishman, who informed me that he had grown the parent vine from seed that he knew had been taken from the Catawba. * * * This grape is a strong and rapid grower, generally maturing its wood well; the fruit is larger than the Catawba, and grows in bunches larger than those of that variety, and more marked in the peculiar richness of its deep-blue bloom. Its season for ripening is some ten days later than the Catawba. Considering the prompt and vigorous growth of this vine, its hardiness, the facility of reproducing it in the open air from cuttings, its bearing qualities, and the appearance and peculiarities of the fruit, I should deem it worthy to receive the careful attention of fruit-culturists generally.

Mr. J. Chopel, of Eastmanville, says that the Concord, Delaware, and Rogers No. 4 are the best grapes for that part of the country. He has sixteen varieties in cultivation, and the three above named are all he would recommend for general cultivation.

The climate of Michigan seems to be well adapted to the growth of all kinds of fruit. The January cold of both peninsulas, the upper and lower, especially in the vicinity of the lakes, is much less than that of Wisconsin, Iowa and Minnesota, in the same latitudes, at a distance from the lakes. Muskegon, for instance, has a January temperature four degrees higher than Prairie du Chien, both being on nearly the same parallel. Grand Haven and Port Huron are 5° above Milwaukee, all being on the same parallel, while Detroit is 6° above Dubuque in

winter temperature, and 10° above Fort Dodge, the difference in latitude between the three places being very little. The growing season begins at Grand Haven from three to six days earlier than it does at Milwaukee, and continues from five to eight days later in the autumn. A still greater contrast exists between Grand Haven and localities farther removed in the interior of Wisconsin. The coldest point ever touched by the thermometer at South Haven was in the winter of 1856–'57, when it recorded 9° below zero. Since that time the lowest temperature recorded was 7° below zero. In ordinary winters the mercury does not descend to zero. Summers following severe winters always bring an abundance of fruit. The uniformity of heat and moisture is well adapted to the growth and productiveness of the fig. The fruit-buds start with the leaf-buds, and after the first year yield two crops. Cuttings, taken from bearing-stocks, yield a crop the first year. The *Vitis Bordifolia*, (winter or frost grape,) having the lowest vital temperament, thrives with little care. The *Vitis Æstivalis*, (or summer grape,) of which the Delaware is the lowest-tempered variety, though less hardy as a class, also does well. So of the earliest varieties of the Labrusca family, of which the Iona is the highest type.

Point de Peau vineyard is situated on Lake Erie, a few miles below the mouth of the Detroit River. It is one of several points which here jut out into the lake. The area of land is about 25 acres, but the whole is not planted with grapes. The vines are six years old, and the varieties include Delaware, Concord, Catawba, Ives's Seedling, Norton's Virginia, and Hartford Prolific. The system of cultivation followed is the renewal, and has proved very successful. During the first two years a stake was used for the support of the vines, but after that time the trellis was found necessary. The grapes raised in this vineyard are principally used in wine-making. The crop of 1870 was found to yield wine at the rate of a gallon to every 17½ pounds. An acre averaged about 6,000 pounds, and therefore produced about 350 gallons of wine. A test of the wine-making qualities of this crop showed the following result: Catawba yielded 83° of sugar and 9¾° of acid, with the thermometer standing at 66°; Delaware, 91° of sugar and 8¾° of acid; Ives's Seedling, 78° of saccharine and 6½° of acid; Norton's Virginia, 97° of sugar and 13° of acid. A mixed must, composed of one-half Concord, one-fourth Norton's Virginia, and one-fourth Ives's Seedling, gave the elements of a first-class wine of about the strength of ordinary Burgundy, viz, 84¾° sugar and 6¾° acid. The whole vintage reached 67,000 pounds of grapes, and produced about 5,000 gallons of wine.

The aggregate amount of grapes raised in the vicinity of Spring Lake this year will reach 140 tons. The largest vineyard in this section is that of Mr. Hunter Savidge, which contains 2,000 vines. Mr. Martin Walsh has 1,426 Concord vines, from which he shipped 280,550 pounds of grapes, or 14 tons 550 pounds, for which he realized 3 cents per pound net, or $841.65 from the product of 2 acres and 36 rods.

Pear-culture has not been fairly tested, but peaches seem to do well in almost every section of the State. Mr. George H. Lovell, of Spring Lake, has 4,500 peach-trees, from which he shipped 7,000 baskets, receiving for same $3,500; Mr. Charles E. Soule, of Paint Orchards, has 299 bearing peach-trees, mostly Early Crawfords, which produced 2,241 baskets, the gross sales of which amounted to $1,416.93; Mr. J. B. Soule has 2,000 three-years-old peach trees, of early varieties, from which he shipped 1,000 baskets; Mr. Hiram Beckwith, of Spring Lake, gathered 10 bushels of pears from two trees.

The number of bearing-trees and vines, and the production of fruit in

the territory known as the "Fruit Belt," of Michigan, for the year 1871, is given as follows:

Twenty-seven thousand eight hundred and fifty-nine peach-trees; 7,187 apple-trees; 600 pear-trees; (Mr. H. Beckwith has a quince orchard of 200 trees;) 24,232 grape-vines. Product—38,592 baskets of peaches; 220,308 pounds of grapes, or 110 tons; 1,586 bushels of apples; 19,201 quarts of berries. Net proceeds, including pears and quinces, $31,789.33.

Large yields of fruit are given by fruit-growers in the neighborhood of Saint Joseph. The "Cincinnati Orchard," containing 60 acres of peach-trees, netted $17,000. Z. D. Nickerson, in 1868, from 480 trees, took 3,100 baskets; in 1869, 3,500 baskets. Mrs. A. N. Kelly, in 1869, from 900 trees, five years old, took 5,000 baskets. A. R. Nowlen, in 1869, from 3,000 trees, took 10,000 baskets. N. D. Brown, from 20 acres of fruit, of all kinds, in three years, netted $14,000. Strawberries, if properly cultivated, net from $200 to $400 per acre.

A committee of the Union Farmers' Club, of Romeo, recommend the following varieties of apples for general cultivation: Summer—Codling, Red Astrachan, and Sweet Bough; Autumn—Farneuse, Holland Pippin, and Porter; Winter—Rhode Island Greening, Canada Red, Baldwin, Northern Spy, Esopus Spitzenberg.

Professor Kedzie, of the Michigan State Agricultural College, contributes a paper on yellows in peaches. While experiments have not yet fully demonstrated the fact, he is, nevertheless, inclined to the belief that the disease is caused by fungoid growth. He states that digging a shallow trench around the tree, and filling it with boiling water, will soon cause the disease to disappear. He has seen trees which were yellow for years soon become green after this treatment. A heavy dose of potash will also destroy the parasite. Still another remedy is given, that of filling the trench with ashes and pouring boiling water over it. This remedy has proved very successful in the peach-orchards of Benton Harbor.

MISSOURI.

The seventh annual report (1871) of the Missouri State Board of Agriculture contains 677 pages, and is of more than usual interest. In addition to the usual business transactions of the board, the report gives the proceedings of the State Horticultural Society, a number of essays and debates on interesting topics, reports from numerous county and district associations, proceedings of the fifth annual meeting of the Mississippi Valley Grape-growers' Association, the report of Mr. Charles V. Riley, State entomologist, a list of the premiums offered and awarded at the eleventh annual fair of the Saint Louis Agricultural and Mechanical Association, &c.

The report of the secretary gives evidence of rapid advancement in the agricultural and horticultural interests of the State, and of gratifying progress in the productive industries of the people generally. The report of the entomologist is copiously illustrated, and is replete with matter of an instructive and valuable character. In his introductory remarks the secretary says:

All that is wanted to elevate Missouri to the queenly rank she is destined to occupy among her sisterhood of States, is to develop the wonderful resources Providence has so bountifully spread beneath the surface of her soil; to open her mines; to till her fields by the assistance of improved methods of agriculture; to encourage and promote education, and the diffusion of morality and intelligence among the young generation which is growing up to take our places. Our lands are distinguished by an abundance of wood, water, and natural grasses; the air is mild and the climate temperate; our fruits are among the most delicious; the fertility of the soil invites and rewards the husbandman.

At the December meeting of the board an essay was read by Mr. O. H. P. Lear, on the subject of blue-grass. As to the proper time and mode of sowing this grass, Mr. Lear says:

I have received a communication from Colonel John Nichols, of Marion County, who is one of the oldest and most successful farmers in Northeast Missouri. He has been experimenting with blue-grass for over thirty years. He says that the seed should be sown in August, at the rate of four pounds of clean seed per acre, on well-prepared land, and that it should not be pastured until well set or sodded; and further, that stock should not be turned on it to graze before the middle of May, and should be turned off by July, in order to let it grow for winter pasture; thus treated, that it is of more value than clover to the farmer. He further says that it is economy to prepare timbered land; after clearing out the undergrowth, to pasture with sheep, for three years, very closely, or until the land is bare of vegetation, and the leaves and limbs of the sprouts are all eaten off, until the first of July. Then put the sheep on good pasture to recruit by cold weather. By thus utilizing the labor of sheep, he can kill out the sprouts much cheaper and also much quicker than by hand-grubbing. He further states that good blue-grass is the cream of all grasses, and is worth $4 per acre annually; that it does not impoverish the land, but, on the other hand, will improve it by the droppings of stock and the decomposing of its fibrous roots. Horses, mules, and sheep do well on it during winter, if well grown and the snow does not get deeper than five or six inches.

In a discussion which followed the reading of this essay, Mr. Harris said that for early spring, late autumn, and winter pasturage blue-grass was without a rival. If the pasture has a good coat of grass on when winter sets in, all kinds of stock will do well on it without other feeding, during winter, while the ground is not covered with snow. Its capacity of growing at any temperature above the freezing-point enables it to grow during warm days in winter, and brings it forward rapidly in spring in advance of all other grasses. Its only drawback is, it cannot stand drought, and in July and August it parches up entirely, but immediately comes forward when the rains return. Its impatience of drought imposes on the farmer the necessity of providing a substitute for it for two or three months in summer, which, however, is easily done. In sowing it is Mr. Harris's custom to mix the seed with clover and timothy, which occupy the ground until the blue-grass is fully established, which is from two to three years.

Sheep-husbandry is attracting considerable attention among the farmers and stock-raisers in various sections of the State, and a growing demand is apparent for better grades for both mutton and wool. Experience has demonstrated that many portions of the State are admirably adapted to the successful rearing of sheep. At the December meeting of the board, Mr. G. W. Kinney read an essay on the importance of crossing the native stock with pure-blood Cotswolds, Leicesters, or Merinos. The best grades for both mutton and wool are most surely attained in this way, and the health and hardiness of the breed are greatly insured. Speaking of the native stock, Mr. Kinney says:

The native long-staple, coarse-wool sheep of Missouri are a good basis for a flock for the common farmers. They are a healthy, hardy animal, used to taking care of themselves. The ewes are prolific, and good nurses, giving plenty of milk, and by crossing them with the Leicesters we would improve the fineness of the wool and the length of the staple, thus getting a second quality of combing-wool at the first cross. By continuing to use full-blood bucks we should improve the quality of the wool, but, perhaps, at the expense of hardiness and prolificacy—we should have better lambs, but fewer of them. By crossing with the Cotswold, we should not improve the quality of the fleece so much as by crossing with the Leicesters, but we would increase the quantity. We should retain the prolificacy of the ewes and their hardiness, and, perhaps, obtain a sheep better suited to our situation than by any other cross. By either of these crosses the product would be a sheep profitable alike for mutton or wool. By thus crossing for a purpose, always having in view the quality, length, and weight of staple, and the form and size of carcass, a flock can soon be built up to equal the famous improved Kentucky sheep.

Mr. James Harkness, a farmer from Illinois, being present at this meeting, was invited to address the members of the board on the subject of foot-rot in sheep. After exhibiting a number of glands taken from the feet of sheep afflicted with the rot, Mr. Harkness said:

Mr. Page, a friend of mine, had a few very fine rams, worth $200 or $300 each, that became afflicted with foot-rot. I told him a remedy, and he used it and got them nearly all well. He took them to Mr. Forsyth's, and they took the disease again. A boy from Texas came along, and said he knew what was the matter; that there was a small worm in the foot. He took his knife and cut out what he supposed to be a worm, but which proved to be a gland.

Mr. Harkness then exhibited several glands about half an inch in length, looking like worms, which he had taken from between the cloven hoof of the sheep, in front, and showed the location of the disease. Professor Riley had examined the matter contained in the gland with the microscope, and found that the diseased gland contained pus, a black matter, which caused the disease. The remedy is to take a probe and cut into the gland and let the matter out, and then apply a mixture containing two parts of tincture of calendula and one part of tincture of myrrh. When the sore has spread to the bottom of the hoof, pare away the rough part with a knife, and wash it with sulphate of iron, and bind up the hoof with a strip of cotton cloth, wrapped in the cleft in the form of a figure 8.

Mr. Riley stated that he was not satisfied with the theory advanced by Mr. Harkness, that this disease of the gland was the cause of the rot. Nor did he think that veterinary surgeons would agree with him. In reply, Mr. Harkness said that the origin of diseases was always difficult to ascertain. In the foot-rot, the matter that exudes from the sore gland would inoculate other animals; one diseased foot would inoculate millions.

Mr. J. F. Wielandy contributed a very valuable essay on asparagus and its culture. He has devoted much attention to the cultivation of this plant, with wonderful success. In 1870 he exhibited to the members of the State Board of Agriculture three shoots of remarkable size. They were all cut at the same time from the same plant, and averaged about 8 inches in length and 5¾ inches in circumference. Their aggregate weight was nineteen ounces, which is about the weight of an ordinary bunch of twenty or thirty such shoots as are usually sold in the markets. His mode is to propagate from carefully selected seeds, setting aside the earliest and most vigorous plants for that purpose. The above variety was produced in this way, and has been cultivated by him for over forty years. Its great size is due to the most thorough culture and to an abundance of rich manure. The plant requires strong food, and should not be stinted in this respect. His beds are thoroughly subsoiled and trenched. The roots of the plant do not penetrate the soil very deeply, hence the subsoil should not be brought to the surface. Spring is considered the best time for setting out the plants—say during the month of April and the early part of May. Trenches should be made from 8 to 10 inches deep and 3 feet apart, and the plants placed at a distance of from 2 to 3 feet from each other. The ground should be kept loose and porous between the rows, and perfectly clean of weeds. In the spring, as soon as the soil admits of working, it is Mr. Wielandy's practice to give a top-dressing of 2 or 3 inches of light, well-rotted barn-yard manure, being careful to exclude coarse lumps or corn-stalks that might cause obstructions to young shoots in their underground growth. This top-dressing is forked in as lightly as practicable, as it is important that the roots, which are always inclined to seek the surface

of the earth, should be disturbed as little as possible. He abstains from cutting any of the young shoots during the second year following the planting, and cuts but sparingly the third year. Thus treated the fourth year from planting will fully mature a bed.

Mr. R. O. Thompson contributes an interesting article on the mineral resources and agricultural capabilities of the State. According to the statement of the writer, more than one-half of the 42,000,000 of acres of land contained within the limits of Missouri is mineral-bearing. This estimate does not include the great coal-fields in the northern and western sections of the State. Iron ores of a more or less valuable character have been discovered in over sixty counties. This ore is found in vast quantities, that in Iron Mountain alone being estimated, as existing above the level of the valley, at 320,000,000 of tons. The mineral-bearing district of the State is thus located by Mr. Thompson:

Taking the Missouri River as a northern boundary, and commencing at the dividing county line separating Cooper and Saline Counties, passing thence southwestward, the entire region east of these lines may be considered a mountainous one. The western portion of this indicated district presents the magnesian limestone series as the mineral-bearing rocks. Through Vernon, Saint Clair, Hickory, Cedar, Camden, and Laclede, and in a few counties farther east, an old, decomposing, saccharoidal sandstone is presented, passing from northwest to southeast. This sandstone presents, in its composition in several localities, from 10 to 18 per cent. of the oxide of iron. In Vernon and Cedar Counties this sandstone covers the coal series in two localities examined by the writer. But the great and reliable metal-bearing rock of the country is the third magnesian limestone that extends over a great portion of the territory above indicated. In the southeastern portion of the State the porphyritic and granitic formations are presented, and the vast deposits of minerals evidently exhibit unmistakable evidence of volcanic action. The submerged or swampy country of southeast Missouri was undoubtedly depressed at the time, or soon after, the great convulsion which originated in its present form the Iron Mountain, and other elevations of like nature, in that district. The swampy lands contain millions and millions of tons of bog-iron ore, which seems to be the only mineral of any value.

Besides iron, lead, copper, zinc, nickel, and other ores exist in large quantities in several counties of this remarkable mineral-bearing district.

A lack of space forbids an extended notice of the transactions of the State Horticultural Society. Better varieties of fruits are fast taking the place of inferior sorts, and are proving both successful and remunerative. Grapes do exceedingly well, the crop of 1870 being pronounced enormous in quantity and excellent in quality. The wine manufactured from this crop is estimated at 1,000,000 of gallons. Apples rarely fail. The fruit is generally large, and free from specks and worms, and finds a ready market in Saint Louis for all in excess of the home demand. The demand usually being greater than the supply, remunerative prices are generally received for this variety of fruit. Neither pears nor peaches seem to do well in this latitude. The former is subject to blight, and the latter to serious injury from the severe frosts of winter. Alluding to pear-blight, the president, in an address before the society, says that the cultivation of this excellent fruit will have to be abandoned unless some remedy for the disease is speedily discovered. Peach culture is yet in its infancy, and the finer varieties are cultivated but to a limited extent. The president urges the necessity of a carefully prepared list of those varieties which have been found, by actual experience, to stand the greatest degree of cold and yet prove fruitful. He thinks that fruit-growing, as well as other branches of horticulture, would be greatly benefited, especially on large prairies, by planting timber-trees on the north and west sides of each farm, to act as wind-breaks.

At the January meeting of the society occurred a discussion as to the best mode of planting, and the proper treatment of hedges. Mr. I. G.

Munger, a gentleman who has been quite successful in growing hedges, said:

I first subsoil the ground in the fall, as deep as possible, and then plow deeply in the spring, and in every way aim to thoroughly prepare the ground. I sort my plants, putting the best together; then the medium, and so on; make a straight line, and plant with a spade, setting the plants four inches apart; cultivate well the first year, and only cut enough to equalize the growth. The second year I cut down, cut below the ground into the yellow part of the plant. I do not believe in plushing. I can turn out a hedge in three years which a rabbit cannot penetrate. I prune every year. Whenever the hedge gets too big or high, cut it down to two feet high, and it will stop any cattle. Constantly wet ground will kill a hedge.

In the course of an address delivered before the society on the subject of preparing fruit for market, Mr. U. P. Bennett said:

The truth can hardly be too often or too strongly impressed upon the minds of fruit-growers, and especially on those commencing the business, that on nothing does success so much depend in marketing fruit as on having it in good order. Superior fruits always sell quickest, and often at extravagant prices. Assorting and grading fruit, putting all uniformly fine together, and the inferior and damaged by themselves, selling each class on its merits, has always paid me well, and, I have reason to believe, given good satisfaction to the customers. Many persons who appreciate first-class fruit will pay more for that only which is choice and neatly arranged than the producer can get for both superior and inferior packed and marketed together. My mode is to have each picker carry in her hand two quart baskets, into one putting the large strawberries, and into the other the smaller ones; and a moment's care in arranging the berries on top, with the stems downward, gives a luscious beauty to this unsurpassable fruit, and compensates in quickness of sales. I think square quart baskets preferable where the market is several hundred miles distant. Raspberries and blackberries, having no stems or hulls, press more closely together, and therefore do better, when sent long distances, if put into square pint baskets. The berries will generally keep better on the vines, or, if well aired, under the packing-shed, than in close cellars or store-rooms in the city. Everywhere "honesty is the best policy," and dealers are by no means slow in learning to discriminate in favor of the brands of honest packers.

NEW HAMPSHIRE.

The second annual report of the State Board of Agriculture, for the year 1871 was made by the secretary to the governor on the 1st day of May, 1872. It contains 486 pages, and embraces articles and discussions on the following subjects: "A continuation of the history of the State Board of Agriculture, chartered by act of the legislature in 1820," from report of which copious extracts are given; addresses on the "Producing power of the soil;" "Restoration of the hay-crop;" "Grass, and how to produce it;" "The new departure;" "Wheat, and its culture;" "Fruit culture," by Marshall P. Wilder; "A plea for flowers;" "The cultivation of vegetables;" "History and culture of the potato;" "Root-crops;" "Rotation of crops;" "Cranberry culture;" "Breeding and care of neat-stock;" "Cattle husbandry;" "Will farming pay?" "How to make the farm pay;" "Agriculture and manufactures;" "Our forests;" "Making and repairing roads;" "Laws for farmers;" "Drainage;" "Special manures;" "Personal sketches of eminent agriculturists of the State," &c. In addition to these addresses, which are written essays, read before the board at its various meetings held during the year, the report contains the list of premiums offered and awarded at the last State fair, and various other matters of special interest to the farmers of the State.

In his introductory report Mr. James O. Adams, the secretary, alludes briefly to the unfavorable spring of 1871. Notwithstanding a promise of early seed-time, just as the farmer and gardener were ready to commence their field labors, cold winds, freezing nights, cloudy weather, and frequent, but not heavy, rains prevailed, so that less planting was

done than is usual in this latitude. Though wheat was generally sown in that month, and in some places oats to a limited extent, there was but little planting, and far less broad-casting of seed than usual until after the first week in May. There were heavy rains about this time, which were followed by drought. Much of the seed planted failed to germinate, and many fields of corn were replanted at so late a date as to expose the crops to the influences of September frosts. The effects of this drought of three or four weeks' duration cut off the first crop of early vegetables, and proved very disastrous to market gardeners. The early grass crop also suffered seriously. It ripened at a time when the corn crop needed most attention; but small as the crop was, the farmer found it necessary to save it to the neglect of his other crops. The yield was from 15 to 20 per cent. less than the year previous, notwithstanding the crop of 1870 was remarkably meager. There was about an average crop of wheat and oats; barley and rye were cultivated, but to a limited extent; buckwheat and India wheat were regarded as non-compensating products; Indian corn, notwithstanding all the drawbacks of an unfavorable spring, was about an average crop; peas and beans yielded well, while the potato crop was large and generally of excellent quality. Other root-crops were abundant, while the fruit crop, especially apples, was almost a failure.

The State of New Hampshire is composed of 2,319,830 acres of improved land, and about twice that amount of unimproved. The last report of the superintendent of the census showed that there were within the State 37,247 horses, 206,080 neat cattle, 255,047 sheep, and 32,041 swine. The value of this stock is now estimated at $16,000,000.

The board held twenty sessions during the year. Included in this number were those for the transaction of official business, which were few, and those arranged especially for public discussions, which constituted by far the greater proportion. The meetings for public discussions were held at different points in the State, and were generally well attended by the farmers of the neighborhood, who took great interest in the discussions. At the meeting held at Concord Mr. S. C. Pattee addressed the board on the subject of wheat culture. As the result of many experiments he gave the following, as perhaps among the most successful, with the China Tea variety: On two acres of land not exceedingly fertile, some of it dry knolls, and some once very wet but now drained, he raised 45 bushels of wheat from four bushels of seed. The cost of the crop, including interest on land at $75 per acre, one-fourth cost of manure, and all other expenses, was $62.40. The value of the wheat and straw was $110, leaving a balance on the profit side of $47.60. The flour, which was regarded by good judges as worth $10 per barrel, cost him $6.90, including toll and carrying to mill.

Mr. Pattee gives the following as his method of raising wheat:

My method of raising wheat has been, until recently, on the "old plan," the same as that practiced by my father and grandfather before me, for the last seventy-five years, and probably by most New England farmers at the present time; which is to apply all the manure to the corn crop, after which to sow wheat and grass-seed. This course is not objectionable on farms where the rotation will not exceed six years. It is also applicable on farms that contain a large proportion of natural meadow. It is objectionable on my farm, as the rotation will require at least eight years. I have learned this fact: the oftener I can turn under a good rich sod, the better the land produces. Therefore I am adopting a method that gives me a rotation of five years. I break up in the fall as late as possible; the next spring plant corn without manure, except special fertilizers in the hill, either home-made or commercial. As soon as the corn is off, cart on from five to six cords per acre, and plow it in. In the spring, as soon as the ground will admit of working, I take Ford's horse-hoe and give it a good cultivating, sow the wheat two bushels to the acre, harrow both ways, pick off the loose stones, roll it down, and otherwise prepare it for the mowing-machine. The field should not

be left until all lumps and clods are reduced to powder. This extra work pays. The seed will all germinate; the straw will be stiff and harder. It will stand drought better than when the work is left half done.

Mr. Pattee regards the conditions and soil of New Hampshire as excellent for the production of spring-wheat. As to varieties, he prefers the China Tea to all others. This wheat has a long, bearded head, a large, plump kernel, a clean, stiff straw, and is not liable to lodge or rust. The Golden Drop, Arnautka, Carr, (a local name,) and Black Sea he also regards as good varieties. He gives the following mode of preparing his seed-wheat:

I procure refuse salt at the store for half price, make a brine as strong as salt will make it, reduce it so the wheat will not swim, put half a bushel of wheat into a tub, pour on brine enough to cover the wheat several inches, give it a good stirring, and all the foul seeds, if any, will rise and can be skimmed off. Strain the brine into another tub for further use. For every bushel of washed wheat stir in five pounds of clover seed and six quarts of timothy; dry off the whole with equal parts of lime and plaster, using enough so that it can be easily sown. This is a sure preventive of smut, and gives life and vigor to the young plant.

At the Manchester meeting a lengthy debate occurred on the subject of forage-plants and root-crops. Mr. N. H. Brown advocated the raising of turnips, and said they had two advantages over other forage-plants: they could be sowed late, and it required but very little labor to grow them. He liked mangolds, but all could not raise them. He raised the common English turnip, and believed them to be the best. When hay and other forage-plants are light they will be found a great help. He prepares his ground well, turning over sod-land if necessary, or takes that which has produced an early crop, puts on superphosphates, sows broadcast, and generally harvests 300 bushels or more per acre. In the fall he feeds tops and all, but when he harvests cuts off the tops; feeds after milking his cows, so as not to taint the milk; stores in barn-cellar, so as not to scent the house or make it unhealthy; takes cool places and piles up only a few together. Cattle are very fond of them, especially when chopped and sprinkled with meal. The cost of their production is put down at about 10 cents per bushel, but taking into view the value of the plowing and the benefit of the phosphates that remain over, the cost is cut down one-half.

Mr. John L. Kelley coincided with the speaker, but Mr. Warren Brown differed widely in his opinion as to the importance and value of the crop. Many of his neighbors had devoted considerable attention to the raising of turnips, but, after experiments running through two or three years, had found them unprofitable, and had given up their further cultivation. He regarded the crop as expensive in the way of manure, requiring much work in raising and harvesting, and trouble in feeding out, and even doubted its benefit to stock. He also doubted if the land was left in a good condition for succeeding crops.

At the meeting at Frémont Mr. George F. Beede read an elaborate paper on the subject of the restoration of the hay crop. He regards this as a question of paramount importance to the people of New Hampshire. The failure of the grass crop, he believes, is not so much due to drought as to exhaustion of the soil by continued cropping, and a lack of that liberal fertilization rendered necessary by a long and exhaustive drain upon the land. He does not believe the soil is exhausted in a literal sense; it still contains the elements and properties of fertility, and only requires energy and skill to render those dormant elements available for plant food. The grasses will not do well on land that has been long cropped with corn, grain, and vegetables. With the same amount of manure and labor he is satisfied that twice the amount of

hay can be raised by seeding immediately to grass than can be done by cropping with corn and potatoes, to be followed with corn and potatoes again, grain the third year, and grass or clover the fourth. On most soils three-fourths of the value of the manure applied has been consumed in the growth of the three crops preceding the first hay crop. This is on the supposition that the manures were applied to the first and second crops, and the grain sown without manure, as is the general custom.

In answer to a question as to how long a grass-field will produce good paying crops, providing it has been cut early, top-dressed, and otherwise properly managed, Mr. Beede said:

This depends much upon the character of the soil. If it is moist, natural grass-land, or wet land which has been thoroughly drained, it would, without doubt, produce the best results to mow the field from ten to twelve years. The greatest difficulty to contend against is, that the whole process of raising hay is an artificial one; we prolong the vigor and productiveness of the grass plants by artificial means; their natural tendency is to die out in the course of two to five years, and new plants from seed to take their places; and the best cultivated grasses will begin to disappear, except in rare instances, after the tenth year, if we do all we can to prevent it; wild grasses, vines, and weeds will then make their appearance. Now is the time, sooner or later, as the soil and management vary, to plow and re-seed, if we wish to preserve the quality and quantity of our hay. On light lands I should plow often—plant one year if I wished to raise hoed crops, and seed down the second year. I should not mow such fields more than five years—four would be better; say a six years' rotation without top-dressing. I should manage light land, if I wished to seed without a hoed crop, by breaking up late in the fall, manure immediately, and work it into the soil thoroughly; cultivate and harrow again as early as the ground can be worked in the spring, seed with grain and grass-seed, or grass-seed alone; if a dry season it would do better with the grain. I should use larger quantities of grass-seed than on richer land, as the plants do not tiller as much. I have tried this method, and it works admirably.

The great point to be observed in successful grass-culture is to perform every operation at the proper time. When the conditions that govern success are favorable push the work; keep ahead of it. Three of the most important times to observe are these: fall-seeding, if possible, should be done before October; spring-seeding as early as the ground can be properly prepared; top-dressing should be applied the last of October and the first of November. The season for making composts is every day in the year

At the Manchester meeting Mr. John Johnson read an essay on the same subject. As to the proper time of sowing grass-seed, and the management of meadow-land, he said:

There is no doubt, however, that August is the proper time for seeding our grass-lands. That seems to be the time when nature distributes her seeds; and I think grass-seed succeeds better when sown in August than any other month. I believe in natural things, and nature cannot be easily broken down. To seed our ground in August we must hasten our haying, that we may prepare the manure heaps, attend to the plowing, &c.; and it is a great advantage to the farmer to get his haying out of the way at least by the 12th of July. His meadows may be left a little longer; but no English grass, in my judgment, should remain uncut later than the 12th of July.

It is essential that we should plow pretty deep. Many farmers, for August seeding, plow shallow, manure, harrow slightly, and sow their seed, and the first thing they see is the grass growing up from the old roots; the ground becomes nubby, rough, and uneven; and if the next season is dry, its yield will be light and about run out. The ground should be plowed at least from 7 to 8 inches deep, and be thoroughly pulverized before the manure or seed is applied. Again, if we plow in August, and our hay is cut in good season, we may reasonably expect to plow under quite a heavy growth of grass, which is quite valuable to the crop following. The soil should be thoroughly cultivated, and stirred with the harrow and cultivator until it is made perfectly fine, without bringing up the old sod. It is the same with the soil as with all kinds of drugs. We are told by the druggist that the more we rub this or that down, the more strength we get out of it for medicine. Hence the more we work and mix the soil the greater will be its strength, and the greater will be the crop we take from it. Therefore follow the plow with the cultivator or harrow, in order that the soil may be finely pulverized. The manure must be made very fine, and allowed to decompose before it is applied, so that the little roots may take hold of it when the grass first springs up, and not be obliged to wait until it becomes decomposed in the soil. The lack of nourishment will make the plant weak and the first crop light.

In an essay on the producing power of the soil, read by Mr. Levi Stockbridge, the following passage occurs:

New England, with all its skill, intelligence, thrift, and wealth, would be haunted by starvation and famine if the people were compelled to rely entirely on the products of their own soil. Whatever latent susceptibility this soil may possess, certain it is it does not yield sufficient to nourish our people, and but for our peculiar circumstances we should in this respect be in the straitened condition of the population of China, or else be dependent on the whim or caprice of a foreign power for our needed supply. In France, prior to her late disastrous war, we have a good illustration of what a soil is capable of producing when its cultivators are driven, by force of circumstances, to pursue a wise and judicious system of tillage. Its entire territory is less in extent than the State of Texas, yet in 1868 it produced more bushels of all the cereals except Indian corn than the whole United States. That year a population larger by several millions than our own, and more domestic animals than we possess, were supported, and agricultural products to the value of $581,000,000 were sent abroad, while our agricultural exports that year amounted to but $441,000,000. This France has done, and will do again when her industry returns to its accustomed channels.

He then alludes to the impression prevalent among the people of New England, that the soil is worn out and exhausted, and says that the race of man will not be continued on this earth long enough to exhaust its soil of the elements of fertility if it pursues the system of culture which nature's teachings indicate. If in some localities sterility is apparent and the soil fails to yield its increase, it is because the tiller has been a transgressor of natural law, and a persistent transgressor, for nature does not succumb to ill usage until it has been long persisted in. Soil productions, plants, and animals are simply soil changed in form, and not the result of a new exercise of the creative power, or, alone, a mysterious recombination of any materials we may place in it. As the material is of exhaustless abundance, the celerity of the change and the profusion of the products will depend entirely on the combined action of all the great causes of change, and the perfect harmony with which they work. If we would increase the producing power of the soil, we must strive to prevent the action of all causes which interfere injuriously with its producing forces, and, if possible, aid to make their action more potent and rapid. These forces, as primal agents, are water, frost, air; and, second, the chemical influences and affinities which these causes start into activity. They are the great powers of the natural world, and are so far beyond our control that we can only hope to slightly aid them when they work for good, or retard or tone them down when their action is injurious, and then only by aid given to some counter natural influence. After pointing out the effects of these causes or influences upon the soil, and the loss by exhaustion of some of its principal natural elements, Mr. Stockbridge closes his essay as follows:

Manures are indispensable for successful agriculture, but they should be put into the soil not simply to be reconverted into useful plant organisms, but also for the sake of their specific aid in converting the material of the soil into plant food, and increasing its aggregate quantity. To accomplish this object successfully requires as much intelligence in selecting the manure required in a given case, and in determining the best mode of its application and action, as in selecting and applying it for its influence on specific plants. By applying manure for the soil, there is great probability of our harvesting larger crops than if it was applied for special plant production. Take an example: A given acre of land may have in its soil-combinations lime sufficient to supply the amount needed by any crop you wish to grow upon it. But it has none free to act as an alkali on the other elements of the soil. The two great classes of matter are there in proper proportions, and yet it is dead and inactive, and pays poorly for its cultivation. Make an application of lime, though it is not needed as food for the plant you wish to raise. It will act as an alkali on the organic matter, decomposing it and forming carbonic acid and ammonia; these will act on the other elements of the soil and decompose them. The whole soil becomes alive with chemical action, and a series of changes takes place, each one of which develops food out of soil-material. Take another case: A piece of land containing, apparently, all the ele-

ments of plant growth, but is cold, tenacious, and inactive. To get a crop on such land you tell me to apply some fine, well-fermented manure in the hill; this may be well so far as it goes, but for the land you had better apply broadcast, and mix with the soil a strong, coarse manure, which decomposes rapidly. The decomposition, with its power of absorbing the sun's heat, will materially warm the land and give such power and efficiency to other agents that the soil itself, and not simply the manure, is capable of plant production. These are examples of what may be done on a large scale by the action of manures in your fields. Therefore use it freely and judiciously for the soil, and depend upon it the soil will take care of your plants, and consider any substance a manure which contains plant food, or which by its action makes it out of the material of the soil. If we have rightly interpreted nature, the soil in the hand of one who understands its laws of soil-change and development, the influence of each, the combined harmonious action of all, and the power of manurial agents which he can apply or withhold at will—if the soil be in such hands, its producing power is virtually limitless.

Mr. J. F. Lawrence, in an address before the board, urges the raising of millet as a forage plant. He regards it as preferable to fodder-corn for winter feeding. It can be raised on ground too poor for corn; the expense of its cultivation is not so great; it is as easily cured as English hay, and is much more valuable as a forage plant. In an ordinary season, if sowed on warm land, it can be raised after the hay has been harvested from it. He gives the following experiment with this crop.

The 1st of July, the present year, I plowed a piece of land which was mowed the day before, dressed it with 600 pounds of phosphate to the acre, seeded with one-half bushel of millet seed, costing $1, and in September, when in the milk, I cut and nicely harvested two tons to the acre, which is now in my barn looking as green and beautiful as anything I ever saw, and which my cattle and horse prefer to the best hay in the barn. I have never raised a crop more cheaply, or with more satisfactory results, and cannot too strongly urge its cultivation to my brother farmers of the State.

Mr. Otis F. R. Waite contibutes an essay on the subject of rotation of crops, from which we quote as follows:

No one will deny that where the same cultivated crop is frequently repeated on the same land and allowed to perfect itself, its product will, after one or two repetitions, begin to diminish, and if persisted in will in some cases fail altogether. It may be said that the hay crop forms an exception to this rule; but when it is considered that grasses in hay-fields are mowed, and in pastures are cropped, before they perfect their seed, it will be seen that the exception does not hold. If they are allowed to grow to the perfection of their seed, many, if not all of them, are subject to the same rules as other crops. Forest trees are not an exception to the rule. Although they bear fruit when young, and for many years, yet they are a long time in reaching maturity; besides which they supply their own nutriment from the decay of their own foliage. Even in forests nature in many cases clearly indicates the necessity of a change of production. Where oaks are cut down they are usually followed by a growth of pine, and where pines are removed, a growth of oaks springs up—the soft and hard woods thus alternating with each other. * * * * Alternation of crops, or the growing of a regular series of different farm crops upon each and every field in successive order, together with a system of green manuring, or plowing into the soil green plants, has given to Flemish husbandry its great and acknowledged pre-eminence over that of every other country. In Flanders it is said to be no uncommon thing for farmers to carry on the operation of harvesting grain, plowing the ground, and sowing turnip seed all at once, on one and the same field. The ground is plowed up and re-sowed with another and different crop as soon as the grain or other crop is cut off and removed. It is by the same or similar alternations of crops that the farmers of the county of Norfolk and other sandy regions of England, once very poor and unproductive, have converted them into the most fruitful, wealthy, and populous districts of that kingdom. This same system has wrought similar changes of agricultural improvements in Scotland and Germany, and it will, if properly and perseveringly pursued, produce equally beneficial results in our own country. There is nothing in farming that requires a nicer judgment, or on which the farmer's profits more depend, than upon the order in which the various farm crops cultivated are made to succeed each other upon our fields. The green manuring and alternating husbandry, so successful in Flanders, has been adopted to a considerable extent in nearly all the other countries of Europe, and is constantly growing in favor there. Turnips in those countries have been used quite generally as a soil-renovating crop with great advantage, their large, spreading leaves drawing more nourishment from the atmosphere than their roots do from the soil. Sheep are turned into the fields and eat off the tops or

leaves of the turnips, and as many of the roots as they wish, leaving their manure upon the ground evenly distributed, and the field in good condition for a succeeding crop of grain.

Mr. Hiram R. Roberts contributes an excellent article on the subject of how to make farming pay. He regards it as the safest, and in the long run the most advantageous, of any calling within his knowledge, especially for men who have the physical ability for manual labor. To those who dissent from his views, and allege that they cannot keep up the fertility of their farms, he answers as follows:

Most assuredly they cannot keep up the fertility of their land if they take off more than they return to it. There is no need of this exhaustion. Have not a very large proportion of the farms of this State the means upon themselves of keeping up their fertility, when all the manure, both solid and liquid, is properly preserved and judiciously applied, which can be made on the farm? The amount of valuable manure is not small which can be made from one horse, one cow, one hog, and a small family, when the collections from the barn, pig-pen, sink, and privy are all preserved by being mixed with muck, scrapings from the road-side, or even sand. It would seem that the tillage land of our farms ought not to grow poor when properly cared for, for they have the advantage of the manure made from the hay cut on land that needs no dressing, and from pastures, besides what can be made on the farm. Every farmer should avail himself of all the manure, whether natural or artificial, that he can apply to advantage. The doctrine that our farmers should continue to grow poor needs investigation, for all history shows that great crops have been raised for hundreds of years on land from dressing collected from the land itself; and cases almost numberless can be shown in our own State where farms have been greatly improved from dressing made on the farm. But dressing is not all that is needed on a farm to make it pay. He must see that everything on and about the farm is attended to, from January to January; he must see that his land for cultivation is properly plowed when it is not too wet; that his seed is of the first quality; that it be sown or planted at the proper time; that it be not choked with weeds from May to November; that his crops be harvested in due season; that all articles intended for sale be prepared in first-rate order, and be sold at the right time. Take care of everything raised on the farm; let not so much as a bean or an apple be lost for the want of care; have every domestic animal, from the tiny chicken to the noble beef-ox, kept in a constantly thriving condition; keep the best of tools to work with, and see that they do not get out of order by neglect. If help is needed employ the best. Keep fields as free from small stones and as smooth as possible, so that a large amount of work may be done with machinery with horse or ox power; look well after the orchards; prune them every year, and keep the land mellow about them; pay particular attention to the pastures, that much neglected part of many otherwise good farms; drain the wet lands on them, and do not let the cattle into them too early in the spring; cut down, or up by the roots, when it can be conveniently done, all scrub trees or bushes; running juniper, pines, &c., can readily be cut up with a bog-hoe when the ground is frozen. Plow all land inclined to bushes or moss as often as either of these obstruct the grass; sow down with red-top and clover. Ashes can be very advantageously applied. They will aid the grass and keep down bushes and moss. Plaster can be used to good advantage on some soils. All land inclined to bushes and too rocky to be plowed should be allowed to come up to growth.

Mr. J. H. Harvey contributes an article on the same subject, a considerable portion of which he devotes to a discussion of the importance of manures in the operations of the farm. He says that the manure heap can be greatly increased by furnishing hog-yards, cattle and horse stalls with turf, as an absorbent; from the road-side, from under stone walls in the fields, and such corners as no plow can reach. A thousand loads, he thinks, can thus be taken from every small farm, from places where grass has rotted and leaves collected, without bringing the banks down lower than they were fifty years ago. Saw-dust and swamp-mud make a very good fertilizer. He advises that cattle and horses be housed in summer as well as winter, and that absorbents be spread under them to save the liquid part of the manure, which is fully as valuable as the solid. In support of this statement Mr. Harvey gives the following experiments:

In 1857 I spread loam soaked with cattle-urine on one end of a piece of oats, and on the other end solid manure. Where the urine was spread the crop was far the heaviest and darkest colored. Swamp-mud, a thousand loads of which may be found on almost every farm, when rightly prepared by being drawn out beforehand and exposed to rain and frost to remove its acidity, and then mixed with ashes or lime, is another great manurial element. * * * Every acre of forest-leaves, when the rotten mold is three or four inches deep, is sufficient to manure an acre of the field—equal, once in every five years, to twenty loads of barn-yard manure. It contains two out of the four bases required for plant-food, viz, potash and nitre; also a large amount of vegetable matter.

As to the proper application of manures, he says:

I think manure should be harrowed in on wet land and plowed in on dry land. Then, in the first case, it will not be leached and go down below the reach of the plant-roots, nor, in the other case, be too high and dry above them, and its strength evaporated in the air, as it was with me on a piece of corn in 1863. This was broken up 10 inches deep the fall before, and eighty loads of barn-yard manure and compost harrowed in on the furrows. It was planted with thirteen thousand hills of corn, which started well, but soon dwindled and proved not worth harvesting. Last year I made a failure on the other extreme. On less than half an acre of tough barn-grass sward, I plowed under fourteen loads of barn-yard manure and planted with corn, the roots of which could not penetrate downwards in season to reach the manure, and poor corn was again the result. Low land should be plowed, if practicable, even if you have to use a steel plow, and be laid up in beds of about twenty furrows each, leaving a dead furrow between for the water to run off toward the main ditches, and a compost of sand, rather than muck, applied to the surface, soaked with cattle-urine from the barn-yard or under the stable floors, and seeded down to herds-grass. Treated in this way it will bear heavy burdens of grass for a long series of years, the proceeds of which, in the shape of barn-yard manure, can be carried on to the high ground where it is so often needed.

Mr. Joseph B. Walker, in an essay on forests and forest-culture, urges the manufacture of all forest-products at home. He regards the raising of timber as more economical than the importation of lumber for needed articles of manufacture. The difference between a given amount of lumber in the rough and in the manufactured state is much greater than is commonly supposed. A statement, prepared by the president of the New Hampshire State Board of Agriculture, shows that white-pine wood will sell for about $4.75 per cord. This wood, when manufactured into mackerel kits, will bring $25.20. Another statement, prepared by a gentleman versed in the business, shows that 1,000 feet of lumber generally used in the manufacture of furniture is worth $15 in the plank at the mill where it is sawed, but when converted into furniture and ready for market it has increased in value to $75.60.

The secretary gives the names and location of sixty firms or companies engaged in the manufacture of starch within the State. The largest amount manufactured by any one firm during the year was 163 tons, and the smallest amount 10 tons. With one exception, these manufactories are all located in two counties—Coos and Grafton. The total amount manufactured by them is given at 3,060½ tons.

Mr. Dinsmore, proprietor of the Alstead cheese factory, gives the following statement of facts in regard to his operations fo the year:

I commenced making cheese May 10, and continued until September 5, 1871. During that time I made from my 56 cows 20,832 pounds; sold the cheese on an average of 14½ cents—$3,020.64. In the spring and fall I made 1,800 pounds butter, which averaged me 38 cents per pound—$684. Sold 18 hogs, 310 pounds each, at 8 cents—5,580 pounds—$446.40. Received from what calves I sold, $252.10. Total receipts $4,403.14.

Mr. Dinsmore does not give his expenditures, therefore we cannot state his net profits.

OHIO.

The twenty-sixth annual report of the secretary of the Ohio State Board of Agriculture for the year 1871 contains over 600 pages, a large portion of the matter being of a very interesting and valuable character. In addition to the business transactions of the board, it contains the proceedings of the twenty-seventh annual convention of the Ohio State Agricultural Society, held at Columbus January 3, 1872; the premiums offered and awards made at the twenty-second annual fair, held at Springfield during the month of September, 1871; a number of addresses delivered by prominent agriculturists at different points in the State; reports from county societies, and valuable essays on "The best practical means of preserving and restoring the forests of Ohio;" "The wheat-root maggot;" "Poultry-raising—different varieties," &c. Some of the most valuable articles are reproduced from European publications, the more elaborate and exhaustive one being that on the "Importance of analyses of soils," translated from the German of Albert Orth, by Mr. John H. Klippart, secretary of the board. The report also contains the fifth annual report of the Ohio State Horticultural Society for the year 1871.

The annual convention of the State Agricultural Society was well attended, there being present representatives from seventy-eight counties. In his address before the society, President Lang alludes to the many resolutions heretofore passed by the association, urging upon the legislature the importance of the enactment of more stringent measures for the protection of wool-growers. While laws have been passed for the taxation and even killing of dogs, and for the severe punishment of the owners of sheep-killing dogs, the president regrets that these laws have not been enforced, and that the sheep interests of the State are no better protected to-day than if such measures had never been enacted. Touching this point the secretary gives some important statistics. The returns of live stock on tax duplicate shows the number of sheep within the State in 1871 to be 4,468,898, and their cash value is given at $13,843,810. Reliable returns show the number of dogs to be 185,023, and the total number of sheep killed by them 39,726. The total value of the number thus destroyed is $126,874.50.

During the discussion of a resolution tendering the thanks of the convention to the trustees of the Ohio Agricultural and Mechanical College for the prompt location of the same, Mr. T. C. Jones took occasion to allude to the fact that the proportion of the number of farmers who are in public life, in the national and State legislatures, is becoming less. It was just as necessary that farmers should have as thorough and liberal an education as men in any other calling. In the early history of the State governors, members of Congress, and prominent men everywhere were practically connected with agriculture; and it has been supposed that it was necessary for the welfare of a State, necessary for the welfare of the nation, that not only the energy but that a large proportion of the brains of the country should be engaged in agriculture, because without the representation of agriculture it was impracticable to maintain a free government. Mr. Jefferson, with all his confidence in free government, could not exactly foresee how a republican government could be maintained with such a population as we must ultimately have in our large cities. The speaker then stated that, in locating the college, a lack of funds had compelled them to ask donations from competing localities; that Franklin County, having donated $300,000, the whole fund asked for, the institution had been located within its limits.

This amount was larger than the Government donation, and more than half the entire fund of the institution. Out of the Franklin County donation the experimental farm had been purchased and paid for. While the enterprise is now regarded as established upon a permanent footing; still, to place it in an entirely unembarrassed condition, the State is called upon to lend it further aid. Additional help would seem to be necessary in order to finish the college buildings and to make the other improvements contemplated by the trustees.

Professor Edward Orton, of Antioch College, and Messrs. G. S. Innis, S. D. Harris, D. C. Richmond, and Dr. J. A. Warder delivered able addresses on agricultural topics during the progress of the convention. The address of the last-named gentleman was on the subject of the deterioration of soils, and how to retain their fertility. He referred to China and some of the European countries to show that their system of rotation of crops and judicious fertilizing and manuring of soils was the only proper and profitable system of agriculture. China, with a soil originally poor and unproductive, and with no stock to produce manure to enrich it, has been made wonderfully prolific by the untiring industry of its people, and for many centuries past has been able to support its immense population of over 400,000,000 of people from its own resources. Of European countries Belgium is the best cultivated. Notwithstanding the land has been constantly tilled for over a thousand years, the fertility of the soil is such as to produce 50 bushels of wheat per acre, with other crops in proportion. England is another illustration of the advantages derived from a careful, painstaking, scientific system of farming. Less than one hundred years ago wheat averaged only 10 bushels per acre in England. By a proper rotation of crops, by drainage, and a liberal use of manure, the average yield has been brought up to 36 bushels per acre, in some sections as high as 50 and 60 bushels often being grown. Southern Europe, the once fertile plains of Lombardy, presents a good illustration of the opposite system. By cutting off the forests, and continual cropping, the land now scarcely yields any return. Much of this beautiful and originally fertile land is now almost a barren waste, and that which is tilled scarcely pays the expense of cultivation. Of the ruinous system of farming in the United States Mr. Richmond said:

The effects of a bad system of farming can be seen all over the United States. The cotton system of the South is the worst. A very few years with this crop wears out the upland. Twelve years' continual cultivation of wheat in the rich, new lands of Wisconsin will reduce the yield to 10 or 12 bushels per acre.

The great State of Ohio has, in some past years, had to import wheat for her own consumption. Many counties now produce little wheat. I have good authority for stating that in the Miami Valley lands which formerly produced 80 bushels of corn now grow only 40 bushels per acre.

The New England States grow only one-sixtieth the grain they consume, and the great State of New York grows less grain than she consumes. Ohio corn is retailing in Connecticut at $1 per bushel this winter. * * * The soil of some of the New England States had become so exhausted that but little wheat could be grown before my remembrance. Corn, rye, and oats were cultivated to a limited extent. In Massachusetts and Rhode Island, which were first settled, the wheat-crop first failed, then the corn and oats, so that they ceased to become paying crops about 1820. The inhabitants then turned their attention to commerce and manufactures, drawing their supplies of corn and rye principally from Western Connecticut. When I was a boy there was a large grain trade carried on with Boston and Providence from this section. The land was, during this period, cropped to its utmost extent, and soon exhausted, and the inhabitants of Connecticut, like those of Massachusetts and Rhode Island, turned their attention to commerce and manufactures. Upon the opening of the Erie Canal, in 1825, wheat and other grain was brought in, and sold very cheap, from the then rich lands of Western New York. At this period scarcely any grain crops paid the expenses of cultivation, and very little was grown in the New England States, owing to the exhaustion of the land. * * * Our Eastern States are now doing what England

commenced fifty years ago: to import manure, save and make all they can at home and apply it to the best advantage; and they are putting more labor and capital on the land. This course will always result in a corresponding increase of the agricultural productions of a country.

I will give some figures in relation to Connecticut, which I know to be correct. They refer to a strip of land, some six miles long and three miles wide, up Long Island Sound, in a section of country ranking as among the best land in the State. The following is a reliable statement of the amount and cost of manures used there last year:

Old leached ashes, 7,500 bushels, at 25 cents per bushel	$1,875 00
Ground bones, 200 tons, at $35 per ton	7,000 00
Superphosphate of lime, 125 tons, at $50 per ton	6,250 00
Guano, 10 tons, at $50 per ton	500 00
Sea-weed, 10,000 loads, at $1 per load	10,000 00
Salt hay, 3,000 tons, at $10 per ton	30,000 00
Barn-yard and other manures	20,000 00
Total	75,625 00

Under this system the price of land is rising, so that farm-lands there are now worth from $200 to $500 per acre. The yield per acre of any of the given products is about as follows: Onions, 900 bushels; potatoes, 400 bushels; strawberries, from 200 to 300 bushels; wheat, 40 bushels; corn, 100 bushels; hay, 5 tons; and other crops in proportion.

The fertility of the soil being restored, its productive qualities can be retained by a proper rotation of crops. Mr. Richmond's plan of rotation, as practiced by him for several years past with most excellent results, is to plow an old meadow or pasture in the spring, plant it with corn or potatoes two years, sowing to barley the third spring, with wheat put on the land in the fall; the fourth spring seed down with one-half clover and one-half timothy; then, after mowing it three years, pasture it two seasons.

Dr. J. A. Warder addressed the convention on the subject of timber-planting and forest culture. In addition to this address the report contains an elaborate paper, on the same subject, from the pen of Mr. Daniel Millikin. Dr. Warder refers to the fact that from 1853 to 1870, a period of seventeen years, there were 847,911 acres of land cleared in the State of Ohio, a rate which reached nearly 50,000 acres per annum. At this rate it would require but half a century to destroy the entire forests of the State, supposing that the increasing population, already forty-nine persons to the square mile, be no more wasteful of their timber than the present generation. The most valuable timber trees were then enumerated. The black-walnut, the oak, the cherry, the tulip, ash, beech, and pines are those most desired in the arts; but a century or more is required to perfect the trees; and to produce the most valuable logs, two, three, and often more centuries are needed. In the forests of Ohio and Indiana the logs of the tulip and black-walnut often have three and four hundred rings of annual growth. Near Terre Haute, Indiana, a log five feet in diameter contained three hundred and ninety rings, without counting the heart, which was decayed for some inches. Mr. John Lush, near Rockville, Indiana, counted four hundred rings in poplar logs. Mr. Ayres, of Champaign county, Ohio, found a tulip-poplar that was 70 feet to the limbs, and was supposed to be five hundred years old. Notwithstanding the great value of these trees when they arrive at maturity, it would not do to plant them for present profit. The interest accumulates so slowly that no margin would be left in the end. Of thrifty growing varieties, which promise a speedy profit, Dr. Warder gives the following absolute measurements of trees grown in the neighborhood of Terre Haute, Indiana:

Catalpa, fifteen years planted, 21 inches in diameter.
Ailanthus, twenty-four years planted, 22 inches in diameter.

Tulip-Poplar, twenty-two years planted, 21½ inches in diameter.
Sassafras, forty years planted, 22 inches in diameter.
Cottonwood, forty-two years planted, 40 inches in diameter.
Red Oak, fifty years planted, 43 inches in diameter.
Black Walnut, fifteen years planted, 14 inches in diameter.
White Pine, nineteen years planted, 13⅔ inches in diameter.
Chestnut, seventeen years planted, 17⅔ inches in diameter.
Black Locust, thirty-eight years planted, 32 inches in diameter.

The following are measurements of trees standing in blue-grass sod, clay soil, planted at Springfield, Ohio, in 1851:

European Larch, twenty years planted, 10⅔ inches in diameter.
Paper Birch, twenty years planted, 10⅓ inches in diameter.
Red Cedar, twenty years planted, 9⅓ inches in diameter.
White Elm, twenty years planted, 14⅓ inches in diameter.
White Pine, twenty years planted, 14⅓ inches in diameter.
Norway Spruce, twenty years planted, 14 inches in diameter.
Australian Pine, twenty years planted, 15 inches in diameter.
Ailanthus, twenty years planted, 15 inches in diameter.
Burr Oak, twenty years planted, 15 inches in diameter.
Silver Poplar, twenty years planted, 17⅓ inches in diameter.

Others, in cultivated ground and more friable soil, but of same age, measured as follows:

European Larch, 18 inches in diameter.
White Pine, 14 inches in diameter.
Paper Birch, 14⅓ inches in diameter.
Deciduous Cypress, 20 inches in diameter.

Mr. Ezra Sherman, of the White Water village of Preston, Ohio, planted seeds of locusts and red cedar, in 1830. At the age of three years the trees were set out in a grove of 15 acres, and along the highway in an avenue for 200 rods. In 1870, or forty years from the seed, two-thirds of the trees along the highway were cut down. These 180 trees made 1,500 posts, worth 35 cents each, or $525; that is, over $8 per tree. The stakes and top-wood for fuel were worth something besides. Some of the trees in the grove are considered worth $10 apiece, and the 15 acres thus stocked are expected to furnish fence-posts for the whole farm of 1,500 acres for all time. The cedar, though of less rapid growth, is more highly valued. They will make eight posts against thirty of the locust trees. Mr. Sherman considers that the stakes, poles, and pasture of this grove have been worth as much as it would have yielded, if free of trees.

The speaker refers to experiments made by Mr. Schofield, of Elgin, Illinois, who, for the following reasons, prefers the European larch to all other trees: It is hardy, of rapid growth, easily transplanted, and bears being set closely. The timber is unequaled for durability, and having great strength and elasticity, is valuable for various purposes. Every thinning he counts as a harvest. The first, at seven years, he uses for stakes. The second, at fourteen years, furnishes 3,600 fence-posts per acre, which he values at $1,000. The third thinning, at twenty-one years, gives 600 trees, worth $3,000. The fourth cutting, at thirty years, affords him 300 trees, valued at $6,000, making a total yield of $10,000 from one acre in thirty years. He still has remaining upon the ground 300 trees, as a permanent investment, worth $6,000 more, which will continue to increase in value annually.

Mr. Milliken, in his essay on forest culture in Ohio, thus alludes to the immense consumption of timber and wood in the construction and repair of the railroad lines of that State:

Twenty years ago we had but two hundred and fifty miles of railroad in the State the construction and working of which required but an insignificant amount of wood Now we have considerably more than six thousand miles of railroad, a sudden growth,

and but a fraction of what is to come. By a law now in force these roads must be inclosed by more than ten thousand miles of fencing, and how perishable these fences are, all farmers know. These roads have more than 10,000,000 ties, which, lying exposed to air and dampness, decay in five or six years. The aggregate length of wooden railroad bridges in Ohio is nearly sixteen miles, and of trestles more than ten miles. These are perishable structures, and must be frequently replaced; the average age of the 770 wooden bridges in Ohio is only five and a half years, and of the trestles seven years. Moreover, locomotives burn an immense amount of wood, and, although coal is burned on railroads in a rapidly increasing ratio, yet the consumption of wood continues and increases. Ohio locomotives burned, in 1870, eighteen times as much coal as in 1858; but in the same interval the consumption of wood rose from 209,416 cords to 700,000 cords.

Speaking of the great demand already felt for young timber, Mr. Millikin says:

I am acquainted with a region of this State where transportation is so difficult that cord-wood is worth just what it costs to cut it; yet even in this district the woods are thoroughly culled of all young hickory and ash trees, which have been sought by agents and procured by purchase or theft, and have eventually passed into the hands of carriage-makers and other manufacturers. Near the present town of Houston, sixteen miles north from Piqua, General Wayne made an encampment at some time between 1792 and 1795. To avoid surprise by Indians, he caused a space of 10 acres to be cleared. In 1860 the buggy manufacturers offered 9 cents per foot, linear measurement, for hickory, ash, and elm logs on this tract, no log to be more than 10 inches nor less than 6 inches in diameter. The aggregate length of these logs was no less than 25,000 feet.

A few facts given by the writer touching the consumption of timber for telegraph poles are worthy of consideration. He says:

The three great telegraph companies which operate lines in Ohio have four thousand five hundred miles of poles within the State, and eleven thousand five hundred miles of wire; in the United States these companies maintain fifty-seven thousand five hundred and forty-eight miles of poles, and one hundred and sixteen thousand five hundred and sixty-one miles of wire. Besides this, the Marietta and Cincinnati Railroad has one hundred and fifteen miles of poles, and two hundred and fifty miles of wire. * * * Outside of cities, and away from road-crossings, telegraph poles are 25 to 28 feet long, and have a diameter at one end of 10 to 12 inches, and about 5 inches at the other. At this time the so-called white cedar poles of these dimensions are worth 90 cents each in Chicago. Such a price for this timber, which has undergone no manufacturing process and is of very doubtful durability, may give some basis for an estimate of what prices will be twenty years hence, when we shall have, perhaps, two or three times as many miles of telegraph as now, and when the extensive forests of Michigan, Wisconsin, and Minnesota are gone.

In view of the probable high prices of wood in the no distant future, Mr. Millikin says:

No one ought to hesitate about planting choice sorts of timber, even on land worth $100 an acre. December 1, 1871, good hoop-poles for barrels were worth $20 and $30 per 1,000 in Cincinnati. Andrew S. Fuller, author of the Forest Tree Culturist, informs me that 10,000 such poles could be grown on an acre of ground in from five to eight years. If half of these were spared we should have $125, and probably more, as the gross receipts of the first crop. Supposing that the 5,000 poles not cut at first were cultivated for three years, they would be fit for first-class hogshead hoops, and would be worth $40 to $75 per 1,000 in Cincinnati to-day, or say $275 for the second crop. Farmers do not need to be told that this will pay. All the cutting and most of the cultivation of such a plantation could be done between the fall and early spring, when ordinary farm work is not pressing. A hickory plantation would last forever if cut only in the winter, for the sprouts would always grow straighter and faster than the original trunk. And, if the planter sees fit, a portion of plants might be permitted to grow up into trees, and the remainder be destroyed by summer cutting.

Mr. George H. Thurston, president of the Pacific and Atlantic Telegraph Company, in a letter to the writer, commends locust and red cedar posts, and says he never expects to see the decay of such as are used on the line of which he is an officer. Oak poles, which are somewhat used in Pennsylvania and Maryland, decay in from six to eight years. Chestnut lasts from twelve to fifteen years. Tamarack (American

larch) has such ardent friends and enemies that Mr. Thurston withholds his opinion.

The writer gives the following directions as to the preparation of the ground and the planting of trees:

In preparing the soil of steep hills, the margins of water-courses, as well as rocky or gravelly soil, the use of the plow is impossible, and in such situations the spade alone must be used. On such tracts a few trees should be carefully planted, and they had better be of some vigorous variety inclined to sprout. When the ground is partially shaded by these trees, acorns, nuts, or even small trees may be successfully planted, and they will flourish if room is gradually made for them by the ax. For such sites no tree could be better adapted than the black locust, and it is doubtful if the planter would even wish to eradicate it in favor of any other species.

In planting a continuous grove a space of four feet should be left between the rows. One can easily cultivate a strip of that width by going over it twice, and so long as cultivation is needed there will be abundant room for the passage of a horse. If rows were established much less than four feet apart cultivation would be impossible after a few years, and the little trees would need to be thinned when so small that the thinnings would have no value, and the labor and expense of cultivating them would go for naught.

In the rows, plants ought in no case to stand closer than one foot, if it be intended to grow healthy plants. In Europe beautiful hop-poles have been grown by planting larch trees 18 inches by 2 feet, and hoop-poles could be grown as close; but the destruction of the plantation is in such cases looked for as a matter of course, and as regards hickory hoop-poles, it would be better to annually destroy a portion of the plants by summer cutting until the whole crop should be grown on stools four feet each way.

After the first year, then, all trees ought to be at least one foot apart. From a well-managed plantation not a few trees may be sold at different sizes for ornamental purposes, and for these, and other stuff now deemed worthless, a sufficient income would be realized to more than pay the expenses of the first ten years in almost any locality. Where it is necessary to transplant from a seed-bed, the plants should be at once set in rows both ways. They may thus receive perfectly clean culture without any hoeing.

Mr. Millikin then gives directions as to thinning and pruning, from which we quote as follows:

No tree designed for timber should have room to expand its branches laterally into what may be regarded as its normal shape. As rapidly as is consistent with the health of the tree the stem should be elongated, and should be bared of branches, for branches make knots. The planter cannot expect to prune his trees into this shape. In this country pruning to this extent would be immoderately expensive; in any country the removal of large, healthy branches is injurious to most trees, and absolutely ruinous to others. To encourage the upward growth, and to check the nutrition of lower branches, trees are so planted as to slightly crowd each other, and when the vigor of these lower branches is gone, they may be removed without any shock to the tree or injury to the quality of the timber in the trunk. On all coniferous trees the death of shaded branches is extremely rapid, and this is particularly fortunate, since the cutting away of live branches from the pines and spruces is followed by copious bleeding for years, to the exhaustion of the tree, and often to the injury of the bark. The scalding of the bark by the resinous sap of pines has been observed by planters in the West, and one of them recommends to leave a stump four inches long when amputating live branches, and to saw off this stump when bleeding has ceased. But in the plantation it would be better to permit a branch to die without disturbance, and so avoid all unnecessary check to the trees. The planter should, however, be prompt to remove dead branches, because so long as the wood of the trunk is creeping over and enclosing a dead branch, it is making a knot, which will be deep in proportion to the forester's neglect.

The planter should be warned against crowding too much. It is sufficient that a tree should have its branches approached or slightly touched by its neighbors. Thinning should be commenced very early, and should be attended to at least once in three years in any plantation less than twenty-five years old. If long neglected, trees grown too thickly begin to show all the symptoms of old age, and actually die. And even when, before the death of the trees, thinning is commenced in an overcrowded plantation, they are so tall in proportion to the thickness of their trunks and roots that they are broken and uprooted by winds. This constant thinning is its own reward, since, after the first seven or eight years, every tree will be available for stakes and fuel, and afterward for posts, beams, &c.

Reports from county societies show a majority of them to be in a flourishing condition, financially and otherwise. Detailed statements

of the transactions of these associations during the year were received from the officers of upwards of seventy of them.

The Madison County cattle sales, as reported by Mr. Irving F. Willis, evidence an improved condition of the stock of this section of the State. Mr. Irving concludes his statements with the following comparison of sales:

The number of all cattle sold, (6,299 head,) as against 5,401 head in 1870–'71, shows a large increase. The average weight of three-year-old cattle is now 1,132 pounds for the year, against 1,101 pounds last year. Two-year-olds are now 906 pounds; last year 887 pounds. One-year-olds we report at 647 pounds, as against 614 pounds in 1871. Oxen, per yoke, are now averaged at 2,894 pounds; last report gave these at 2,660 pounds. In all of those which comprise the greater part of the whole sales the increase is most satisfactory and large.

The average weights being greater and the numbers reported larger than last year, would of course make a larger number of pounds' weight; but, on the other hand, the average prices and cents per pound, for every age and kind, are largely reduced from the showing of 1871. Three-year-olds were, last year, $64.13; this year, $53.55. While the average of three, two, and one year-olds together, from last report, was $49.59 per head, it is but $40.28 for these ages this year. In last report, three, two, and one-year-olds brought an average of $5.49 per hundred pounds. This year these ages bring $4.53, a falling off of nearly $1 per hundred, which is only in proportion with the general decline in values of all stock within the past twenty-four months. The total cash results, notwithstanding the decline in prices, is almost equal to last year, being about $9,000 less in the footings.

The number of horses purchased is larger than last year. The average price of these in 1870–'71 was $113.37 per head. Our present report shows a small increase, being an average of $115.75 for the year, and for the past six months $125.36, against $116.12 in 1871.

Mr. G. W. Campbell, in his report to the State Horticultural Society, thus alludes to an insect which seems to be doing some damage to the hot-house vines of Central Ohio:

I will mention that I have been examining the roots of grape-vines that have little bunches of knots or bulbs formed on their fibrous side-roots, and by the aid of a strong magnifier find them to be covered by an aphis, or plant-louse, certainly very much like, if not identical with, the *Phyllaxera vittata*, or gall-louse, which produces the knots or galls on the under-side of the leaves on the thin-leaved vines in so many vineyards. I do not know how to account for the fact that I have not seen the work of this aphis on any of the out-door vines on my place this season; but in two of my green-houses there were, in patches, vines affected with these galls. Upon digging the plants it was found that in the places where the leaves had been affected the roots were more or less knobby, and abounding in little bunches of knots so well known to vine-propagators; and upon a careful examination of these knobs or knots with a powerful glass, I found the little rascals in great numbers. Upon smooth roots, or upon vines free from these knobs and knots, I found none of them. Cutting open, I found nothing inside these knots—simply the clear, white substance of the root, the action of the aphis seeming to be confined to the surface of the root. I have not carried my investigations far enough to enable me to form an opinion as to the extent or probable damage done to the vines by this insidious and hitherto unsuspected enemy; but it is not impossible that many of the maladies to which the vine is subject, and which have been hitherto unexplained and unexplainable, may be referred to the hidden workings of this microscopic depredator.

At the November meeting of the society the following-named varieties of winter apples were named for cultivation in southern Ohio: White Pippin, Rome Beauty, Rambo, Baldwin, Putnam Russet, Clermont, Newton Spitzenberg, Milam, and Pomme Gris.

Mr. Campbell, in the report submitted by him at this meeting, speaks of his uniform failure with the Walter grape until he commenced to graft it on other varieties. He says that had he purchased grafts at $20 each when this variety first made its appearance, it would have been more profitable to him than vines at $3 and $5 apiece. He is confident the grape will do better grafted on some other variety than on its own roots.

WISCONSIN.

The report of the Wisconsin State Agricultural Society for the year 1871 has been prepared by and published under the supervision of Dr. J. W. Hoyt, its secretary. The report is one of unusual interest, and in addition to the business transactions of the society, contains a list of the names of those to whom premiums were awarded at the eighteenth annual fair of the Association, held in the city of Milwaukee during the latter part of September, 1871, a synopsis of the addresses delivered on the opening of the fair, together with a number of prize and other essays on the following-named subjects: "Management and rotation of crops of a farm for mixed husbandry;" "Market gardening;" "Practical management of sandy land;" "Dairy farming;" "On the cultivation of the cranberry;" "Planting and management of a vineyard, adapted to Wisconsin;" "The cultivation of small fruits;" "Practical farm management;" "Insects injurious to agriculture;" "Failure in wheat culture;" "Cultivation of Indian corn;" "Hemp culture in Wisconsin;" "The relations of labor and capital;" "Poultry-raising—different varieties;" "Planting and management of an orchard;" "Economical use of straw on the farm," "Pork-raising in Wisconsin;" "Twenty years' lessons in fruit-growing;" "Farm fence;" "The dairy—how to get and keep a good stock of cows;" "Economy in pork-raising;" "Beet-sugar making in Sauk county;" "Bee-keeping;" "Grape culture in Wisconsin;" "Experiments at the University farm;" "Practical experience in orchards;" &c. The work closes with an elaborate report from the pen of Professor John Murrish, commissioner of the survey of the lead district of Wisconsin.

Notwithstanding the weather was unfavorable during the progress of the eighteenth annual fair of the association, the exhibition proved very successful in every respect. The receipts were largely in excess of the expenditures, leaving the treasury in a sound condition.

The secretary, in his introductory report, says that the year 1871, industrially considered, has but little to distinguish it from the average in Wisconsin, except that the late frosts of spring and the drought ot summer slightly diminished the yield of certain crops. He alludes to the destructive fires which occurred in some sections of the State during the year, not only destroying human life, but laying waste many fair and prosperous portions of the commonwealth. The wheat-crop, though of a superior quality, was under an average yield, owing to rust, drought, and the ravages of insects. The oats-crop was fair, in some cases the yield being reported at over 90 bushels per acre. Barley was also successful, the yield being above, but the quality a little below, the average. The corn-crop was 8 to 10 per cent. above the usual yield, and of superior quality. Potatoes did well, while the tobacco-crop considerably exceeded the average, which has always been large. The cultivation of hops, which was formerly a leading interest of the State, has been greatly curtailed. The average in 1871 was probably not more than three-fifths as great as in 1870. The production of flax and hemp is gaining in the appreciation of the farmers of Wisconsin. The increase of production in these staples is believed to be over 40 per cent. above the preceding year. The soil and climate of the State seem to be well adapted to the production of these crops, and it is believed their growth may be made very profitable. The hay crop was above an average one, but the autumn pasturage suffered greatly from the drought. This, together with the low prices of butter and cheese, had a depressing effect upon dairying interests. Increased interest is mani-

fested in stock-breeding and stock-growing, the most marked feature being observable in the rearing of improved grades of sheep for wool. Many new marshes have been planted with cranberries, and the culture is making rapid progress. The apple-crop was from 40 to 45 per cent. above an average, while pears and the smaller fruits produced a fair yield. As fruit-trees become acclimated to the severe frosts of winter, their crops are more certain and abundant, and the fruit of an improved character, both as regards flavor and size. The year, upon the whole, has been a very fruitful and profitable one to the farmer.

Considerable progress is shown in the establishment of woolen factories. The number of mills in the State is given at 54; number of sets of manufacturing cards, 63; number of sets of custom or roll cards, 43. The capacity of these cards, if run the whole time, would be 2,320,000 pounds per annum, but from one cause or another about one-third of the mills in the State were shut down from one to three months of the season. The following is the result of their operations for this year:

Number of pounds of wool manufactured into cloth, yarn, &c	1,500,000
Number of pounds made into rolls for custom-work	120,000
Total number of pounds used	1,620,000

The wool clip for 1871 is estimated at 4,620,000 pounds, which is a much larger amount than the home mills can manufacture into cloth and yarn.

Some interesting experiments were made at the University farm, which are noticed elsewhere in this work. This farm is steadily undergoing improvements under the management and fostering care of the regents.

The secretary deprecates the great desire for large tracts of land, which creates a tendency to careless and slovenly culture. A smaller amount of land, with better cultivation and a more diversified agriculture, is that system which most certainly leads to success. There is no such thing as permanent success without systematic rotation and manuring. But systematic fertilization is impossible without a liberal supply of live stock. The conclusion is inevitable, therefore, that grain-growing must go hand in hand with grass-growing and stock-raising. Here and there one is found who practices upon this manifest principle as if it were cardinal; and such farmers are invariably successful. Few lands are so limited in the range of vegetation but that a variety of crops and stock may be profitably grown upon them. But there are limitations, nevertheless, and they cannot safely be ignored. Disregard of conditions is manifested by the readiness and uniformity with which all rush into a novel enterprise, or turn their whole strength upon a single branch of business, which can only be made permanently successful by giving due attention to the claims of each element and seeking to harmonize them all. Here, as in almost everything else, selfishness and blind greed manifest themselves. The true policy of the intelligent farmer, when he sees all his neighbors turning their attention to pork-raising, would be to turn *his* attention to raising corn, meanwhile omitting nothing essential to steady and uniform success. When any considerable number of farmers direct their attention to the production of a certain staple, to the neglect of a necessary article of consumption, the neglected article must enhance in value because of the shortness of the supply which is generally the result of diminished acreage.

A very valuable paper is contributed by Mr. Gustave de Neveu, on

the subject of the management and rotation of crops of a farm for mixed husbandry. The writer bases his remarks on the following propositions: First, to make the earth yield the greatest possible amount and variety of products necessary or desirable for the sustenance and comfort of the human family; and, second, while doing this, to steadily increase the productive powers of the soil, or at least retain them undiminished. Scarcely two farms can be found precisely alike in all their conditions, therefore no rules can be laid down which will suit the various peculiarities of each. Peculiar conditions require peculiar treatment; each farmer must be guided by the requirements of his soil, the position of roads, exposure, currents of water, &c. In laying off a farm it is desirable, whenever practicable, that the lots be so distributed that each may have access to running water. This being a labor-saving age, the division into lots and the arrangement of the buildings should be made with a proper regard to convenience. Where circumstances will admit, a private road running through the center of the farm, as far as the two most distant lots, with a gate opening into it from each field, will be found desirable. The usual size for farms in the Western States is a quarter-section, or 160 acres of land. Allowing 20 acres of this amount for timber-land, and 10 more for farm-buildings, yards, calf and hog pastures, and lanes, there would remain 120 acres to be specially devoted to crop culture and rotation. These 120 acres the writer would divide into six lots, containing 20 acres each; three should be kept constantly in clover, or clover and timothy; one in pasture in connection with the timber-lot; the other two, grass-lots to be cut for hay. Of these the oldest seeded may be used for fall pasture, and the other mowed for a second crop of hay or grass-seed. The lot used for summer pasture having been in grass for three years, should be broken up in the spring following for a crop of corn, potatoes, and other hoed crops. This is the writer's plan for restoring exhausted, overworked soils. Of course, virgin soils require no rotation of crops; but the raising of grain should invariably be conducted with the view to the future introduction and cultivation of the grasses and to a regular system of rotation of crops. Whether stock-raising, dairying, or the raising of grain is to predominate, or whether, as appears preferable, all these are carried on in fair proportions, successful farming must have for its basis the raising in a large measure of the cultivated grasses, and more particularly that of clover. This, then, would be the proper rotation: the first and second years in clover, or clover and timothy mixed; the third year in pasture; the fourth in corn and hoed crops, and the fifth in wheat. With land of ordinary quality, treated in this manner, the yield of wheat will usually average about 25 bushels per acre. There remains one more season to complete the course. For this, plow the wheat stubble under as soon as possible. If there is manure to spare, after putting enough on the pasture-lot, spread it on that which is to be sown with the light grains, oats, barley, &c., and seed down. The writer prefers to sow grass-seed before the last dragging of the field, and states that he never met with a failure when sown in this way. Seeding immediately after the last dragging is also a good method, providing no heavy rain intervenes to pack the ground before it is done. Grass-seed cannot be buried as deep as other grains; as a general rule the larger the seed the deeper covering it requires; for this reason he does not approve of mixing grass-seed with the grain in the drilling machine or the broadcast sower, as much of it must be covered so deep as to never come up. The same system of rotation is repeated for another term of six years. If the proper division

of lots has been made, there will be constantly upon the farm one field of corn, potatoes, &c.; one in wheat, one in oats, barley, and light grains, and three lots, or one-half of the farm, in grass. All the lots in grass should receive a dressing of plaster each year; that in corn should also be plastered at least once during the early stages of its growth.

After enumerating various methods for restoring worn-out and exhausted soils, preference is given to that set forth above. Pasturing is the least expensive and most profitable system, in that the farmer's animals are made to perform the work of enriching his land while accumulating valuable products in flesh, milk, or wool.

A large portion of the lands of Wisconsin is composed of a warm, thin, sandy loam, and is therefore easily exhausted of all those elements necessary to vigorous plant-growth. To prevent the exhaustion of these lands, while at the same time they are required to yield an income to the cultivators of the soil, is a question which seems to be receiving the attention which its great importance demands, especially among the more intelligent class of farmers. Two essays are contributed on the practical management of sandy lands; one by Mr. J. G. Knapp, of Madison, and the other by Mr. J. W. Wood, of Baraboo. The essay of the first-named gentleman having been awarded a prize, we quote from it as follows touching the qualities of this soil and the crops least likely to exhaust their fertility:

From the best information furnished by science of the manner in which plants grow, it is inferred that they find their main supply of food near the surface of the ground. From that fact it may be adduced that in the thin soils of the sand the soil should always be kept, as far as possible, on the surface, and never buried beneath a thick layer of the lower barren sand. This principle is well understood and acted on by the tillers of the sands in the Southern States; and to it may be traced their opposition to the "turn-over" plow, as they term the plows used in the Northern States. This subsoil of barren sand ought, nevertheless, to be stirred, though it be not brought to the surface. Roots of plants in quest of water will penetrate into the ground, and the stirring of the subsoil to the depth of 8 or even 12 inches will greatly aid this plant action. Such roots penetrating and decaying in the sand will in time form a soil to a proper depth. After that depth of soil has been obtained, the furrow may be turned as deep as desirable. The result may be expedited by a free use of salt, wood-ashes, lime, or sulphur, all of which dissolve the silex of the sand and fit it for the use of plants; hence a free use of these, or some of them, applied to the surface in connection with vegetable manures, is of great value, and would largely compensate for a natural deficiency of clay in the soil, or where that material cannot be procured. Some, or all of them, are valuable on all lands in this State. Until a good depth of rich soil has been formed the surface only should be turned over, and in these sands the turning should be done while the herbage is yet green, or after the first frosts. The subsoil can be stirred by means of the teeth or knives of a properly constructed cultivator, penetrating to the desired depth in the bed of the shallow furrow. Such an implement would thoroughly loosen the earth, but would not bring the barren sands to the surface.

Wherever there is sufficient vegetable matter in the soil to grow the plants, no lands in Wisconsin produce grain, corn, or potatoes of so fine a quality as do these same sands. The wheat grows here heavy in the kernel, and the straw is so stiff that it seldom or never falls. Corn matures rapidly, and is always sound and ripe. Potatoes yield much larger crops, ripen better, are more mealy, and consequently are more nutritious and valuable than those grown farther south, or on the clay soils. This is an exhaustive crop, but the proper manures to keep up the lands for its production are found in the fire-place and the stable. Whatever crops may be grown on these lands, those are preferable which yield a large amount of leaves, straw, or other vegetable matter, to be left where they grow, or returned to the ground in the shape of stable manures. The grasses and clover are foremost of all, followed by corn and grains.

The writer then enumerates some special crops which can be profitably grown on these thin lands, among which he mentions pumpkins, squashes, grapes, raspberries, blackberries, mustard, poppies, hemp, &c. Of mustard and hemp he says:

Black mustard is a crop that delights in a sandy soil, and leaves a large amount of leaves and stalks to enrich it. All of this refuse should be allowed to rot on the surface, or be buried in the soil while green. Few crops, when the modes of handling are understood, yield more profit. Mustard-seed is brought to market as mustard-flour, or manufactured into table oil, in the production of which it rivals the rape, olive, and almond. Mustard seeds itself, and the land only requires working with a cultivator or harrow each spring as a preparation for the crop. When required for other crops, the land is easily cleared by turning under the green plants, or by cultivating corn. The soil would increase in quality by continued croppings of mustard, as it does not exhaust the salts.

Hemp is another crop which yields a very large amount of leaves, chaff, roots, and stems. If the leaves are left in rotting, and the shives are returned to the ground, they will be sufficient to maintain the fertility, and the soil will never depreciate while cultivated with hemp. If there is sufficient humus in the soil to force the crop, returning the refuse afterward is all the soil requires. Hemp-fiber is almost pure carbon, and the seeds are not allowed to mature when fiber is the object of the crop; therefore, as it takes the smallest portion of salts from the soil, it exhausts the soil less than any other cultivated crop. Its true value is less understood than any crop grown by our farmers. It is safe to estimate that for fiber it will produce from $75 to $100 per acre, and for seed from $50 to $75. There is no doubt of the possibility of growing and maturing hemp in Wisconsin of better fiber than farther south. The seeds may be sown in the fall, too late to sprout, or at the earliest possible period in the spring, on lands prepared in the fall. The young plants, unlike flax, are not destroyed by spring frosts. When grown for fiber hemp kills all other plants, as it covers and shades the entire surface. For seed it must be grown in drills, and cultivated in its early growth. The yield is as high as 40 bushels of seed to the acre. Unlike ordinary farm-crops, it prefers the same tract of land from year to year, if its refuse is left on the ground.

The writer states that the single-flowered or opium poppy is another crop which thrives on these lands. The great value of this crop consists in the very large crop of seeds—from 20 to 40 bushels of 60 pounds to the acre—which are gathered by cutting off the balls, so that all the leaves and stalks are left on the ground to enrich it. An important fact to be borne in mind is that mustard, hemp, and the opium-poppy will yield abundant crops on soils too thin for even the production of grass. Such sandy lands as naturally grow only the most noxious weeds will produce these crops in abundance; and for the amount of vegetable matter they will yield, in the form of tap-roots, leaves, and stems, in a very few years they will convert drifting sands into a soil capable of yielding good crops of clover, grass, and grain.

The same writer contributes a paper on hemp culture. He regards the climate and soil of Wisconsin as peculiarly adapted to the growth of this staple, and gives directions for its planting, cultivation, and the preparation of its fiber for market. As the annual reports of this Department contain all necessary information on these points, we refer only to what Mr. Knapp says, as to the profits of hemp culture:

Rough-dressed lint, as it comes from the break, has sold at Saint Louis during the spring of 1872 at $70, common; $80, good; $90, prime; $92 to $100, strictly prime to choice; $175 to $180, dressed; good hackled tow at $80 per bale of 500 pounds. These prices make the lint worth 14, 16, 18, and 35 cents per pound, respectively. New York quotations are still higher. Land which will yield 50 bushels of corn, or 12 of wheat, will produce a thousand pounds of undressed lint per acre. The average crop in Kentucky and Missouri has been from 800 to 1,000 pounds of dew-rotted lint per acre. Wisconsin ought to give as large a yield. Raised for seed, its yield is from 30 to 45 bushels per acre, worth $1.50 per bushel or more, and the coarse lint from the seed-straw is worth $60 a bale, which will more than pay the cost of cultivation. Thus it will readily be seen that but few crops will surpass it in profit. Last year a farmer near Kankakee, Illinois, was paid $100 for the hemp-straw which grew on an acre of land, after it had been rotted on the ground where it grew.

Mr. David Williams contributes a paper containing some valuable statistics as to the cost of building and the keeping in repair of fences. As available timber for fencing diminishes, the importance of this question assumes a rapidly increasing interest. Mr. Williams says:

At present farmers in fully one-half of the improved portions of the State are restricted to posts and boards for all farm-fences; and not only the cost of this material, but its quality, its rapid deterioration, the diminishing supply, and the somewhat feeble character of its resisting power to the assaults of farm stock, present questions of very considerable importance for study and experiment. The actual aggregate cost of farm-fences to the farmers of this State so very far exceeds any estimate likely to be made, that I have, with the assistance of a number of well-informed farmers of this county, (Walworth,) made a careful computation of the first cost, annual deterioration, per cent., and cost of annual repair. There are sixteen townships, or seven hundred and fifty-six square miles, in the county. Estimating one-sixteenth as lake, ponds, or abandoned lands, gives five hundred and forty square miles, or 345,600 acres of improved or inclosed land. This, if fenced into 40-acre lots, will require five rods of fence to the acre, (a careful estimate gives 25 acres as the average size of fields,) or 1,728,000 rods of fence, exclusive of ornamental and village fences. Estimating one-eighth of this as division fence, and therefore duplicated in the foregoing estimate, and to include also temporary and comparatively worthless fence, will give in even numbers 1,500,000 rods of farm-fence for the county, 100,000 rods for each township (one-sixteenth of the total area having been thrown out of the estimate as lakes, ponds, or abandoned lands) of improved or inclosed lands. From carefully prepared data I find about two-fifths to be highway-fence, making 600,000 rods of highway-fence for the county, and 40,000 rods for each township.

Estimating the cost of this fence at $1 per rod gives $1,500,000 for the county, and $100,000 for each township. Two-fifths of this for highway-fences give $600,000 for the county and $40,000 for each township, or a total cost of all farm-fences of $4.34, nearly, per acre, and a cost of $1.73 per acre for highway-fence. Estimating 10 per cent. on first cost for annual deterioration and repairs, and 7 per cent. interest on first cost, gives $275,000 as the aggregate *annual* cost of farm-fence for the county, and $18,333.33 for each township. Fully two-fifths of this are for highway-fence. If to this sum be added the cost of village-fences—mainly made necessary by the pernicious habit of using the highway as a public pasture—the total cost of fence for the county will be swelled to the considerable sum of $1,750,000, and the annual cost to $297,500.

The report contains a communication from Mr. W. Weferling, superintendent of the Sauk County Beet-Sugar Manufacturing Company, giving a detailed statement of the operations of the establishment for a period of sixty days. His experiments demonstrated the success of the enterprise, though the results in all respects were not entirely satisfactory. The writer states that the conditions for raising the sugar-beet in Sauk County are excellent. The soil is mild and normal; extraordinary salts are not present in injurious proportions; saltpeter, which in some localities has occasioned the total failure of like enterprises, is not found here at all. This important fact gives vitality to the enterprise, and guarantees success in the future.

The company last year planted 230 acres of beets, which yielded four and one-half tons to the acre, or a total of 1,035 tons—not enough in the aggregate to keep the establishment running for more than two months out of a season reckoned at five months. The yield and valuation of these 1,035 tons, or 2,070,000 pounds, of beets are given as follows:

Sold 450 barrels, of 220 pounds each, or 99,000 pounds, A sugar, at 12½ cents.		$12,375
Sold 79 barrels, of 220 pounds each, or 15,400 pounds, B sugar, at 11½ cents.		1,771
Unsold, 100 barrels, of 200 pounds each, or 20,000 pounds, raw sugar, at 9 cents		1,800
Totals	134,400 pounds sugar, at	15,946
Add 72,350 pounds molasses, worth		723
Total valuation of saccharine products		16,669

Estimating the capacity of the factory at 25 tons per day, and dividing the total number of days into the total amount of the above valuation of the products of the business, gives a total income per diem of $402, or, in round numbers, $400. The expenses of the establishment in working out these results, though normal in respect to the capacity of the factory, amount to a much larger sum, relatively, than would be necessary if the capacity was twice as great. Stated accurately, they were as follows:

Twenty-five tons of beets, at $4 per ton	$100 00
Fuel, 13⅓ cords of wood, at $3 per cord	40 00
Wages for 65 hands, at $1 per day	65 00
Salaries (per one year, divided by 60 days—short season)	40 00
Various items, including commissions and insurances	156 00
Total expenses per day	401 00

The superintendent states that these unsatisfactory results are chargeable, first, to non-maturity of beets; second, to the inferior quality of the factory; third, insufficiency of supply to keep even this small establishment running the full season; and, fourth, the low price of sugar. Still, it has been demonstrated that the business will succeed if the above conditions can be changed. Two of these conditions—increase in capacity of factory and a full supply of beets to keep it going the full season—are no doubt within the control of the company.

The economy of increasing the capacity of the factory to the working of 50 tons of beets per day will appear from the following tabular statement, which is based upon precisely the same conditions as to quality of beets, period of working, and price of products:

198,000 pounds A sugar, at 12½ cents	$24,750 00
30,000 pounds B sugar, at 11½ cents	3,542 00
40,000 pounds raw sugar, at 9 cents	3,600 00
144,000 pounds crude molasses, at 1 cent	1,440 00
Total valuation	33,332 00
Proceeds per day	880 00

The cost of manufacturing per day is given as follows:

Beets, 50 tons, at $4	$200 00
Fuel, 21½ cords, at $3	64 00
Wages, 85 hands, at $1	85 00
Salaries, 60 days	40 00
Various items, classed as "sundries"	226 00
Total expenses per day	615 00
Total cash proceeds per day	880 00
Net profits per day	265 00

Estimating the proceeds and expenses of a business involving these same conditions, as to quality of material and price of products, (but with a deduction in the items of sundries,) for a full period of five months, the superintendent gives the net profits of the factory at $294 per day.

DONATIONS TO MUSEUM.

Name.	Residence.	Article.
Aiken, D. Wyatt	Cokesbury, S. C	Bird found in phosphate-beds of South Carolina.
Atwater, Dorence	U. S. consul, Tahiti	Samples of cotton.
Baker, William E	Eshcol, Perry County, Pa	Grasshoppers.
Bartlett, E	Vermillion, N. Y	Excelsior oats.
Batchelder, D. W		Fish-hawk; green heron.
Bennet, J. D	Anamosa, Iowa	Specimens of *Diapheromera femorata.*
Blackburn, John A	Victor, Iowa	Samples of spring-wheat.
Bliss, B. K. & Son	New York, N. Y	Two samples large white and large red Tripoli onion.
Do	do	General Grant cucumber.
Brandywine Farmers' Club.	Chester County, Pa	Corn from John S. Hope; four acres average 120 bushels, shelled. Corn from Charles L. Cook; one acre average 115 bushels, shelled.
Bredt, F., & Co	178 Fulton street, N. Y	Aniline colors used to size silk, linen, and worsted.
Brower, Isaac M	U. S. consul, Levuka, Fiji Islands.	Cotton and fiber of *Broussonetia papyrifera*, or paper-mulberry "pappa."
Bryant, Charles	Special agent Treasury Department.	Seal-skin from Saint Paul's Island, Alaska.
Cassel, J. F	Wakefield, Md	Orinoco tobacco-leaf, seed from Department.
Chapman, Capt. T. F	Red River Landing, La	Calcutta jute-seed and jute sample.
Davis, Miss	Somers, Conn	Three ears pop-corn.
Dillingham, J. P	New Berne, N. C	Specimens of cotton-insects.
Eastman, Prof. J. R	Washington Observatory	Papyrus from Syracuse, Sicily.
Epping, J. P. M	Laurel Point, Grahamville, S. C.	Green seed-cotton, fine, two samples.
Fallon, H. J	New York City	Cotton from Venezuela, and cotton-bale.
Ferguson, P. Rice	Spencertown, N. Y	Horn of African sheep; bags made of bark; one leather pouch; knife and sheath, and specimen of fabric.
Fessenden William	Nashville, Tenn	Head of wheat taken from an adobe brick in New Mexico.
Filts, R. H	Lawrence, Kans	Twigs punctured by insects.
Finch, D. L	Vienna Station, Va	Specimen of corn.
Findley, Samuel M	Lane County, Oreg	Rice pop-corn; squirrel-skull, showing deformed tooth.
Foster, S. D	Windham County, Conn	Hickory-nuts and butternuts.
Francis, R. W		Egyptian cotton.
Halderman, H. A	Wabash County, Ind	Flax samples.
Hastings, H. S	Nockenut, Tex	Chaparral-cock, (*Geococcyx californicus.*)
Henry, R. P	Washington, Ky	Insects.
Herstine, D. W	Philadelphia, Pa	Fine specimen of dark Brahma hen.
Hyam, B. D	Washington, D. C	*Pimpld lunator*, fine specimen.
Jewell, P. A	Lake City, Minn	Hesper rose crab-apple.
Lewis, William L	Louisville, Miss	Specimen of corn.
Lewis, J. M	do	Sorghum-sirup.
Merwin, P	Washington, D. C	Ramie from New Orleans.
McConnell, James H	Springfield, Ill	Indian mallow, (*Abutilon avicennæ.*)
Do	do	Indian mallow fiber.
Moffitt, Daniel		Fungus, (*Dædalea querceria.*)
Moore, M. M		*Corydalis cornuta.*
Nance, W. L	Nashville, Tenn	Corn, 60 pounds to the bushel, shelled.
Paige, C. H	Algona, Iowa	*Cecropia.*
Payne, J. M., M. D	Garner's Station, Miss	Ocelot-skin, (Texas leopard-cat.)
Peters, Richard	Atlanta, Ga	Sunflower-seeds, variegated.
Ridgely, W. C., esq	Bethany, Brooke County, W. Va.	Sample of wool from fleece that weighed 15 pounds.
Saunders, William	Washington, D. C	Worms forming a snake-like mass, (*Sciara.*)
Schaeffer, Dr. E. M	do	*Ceratocampa regalis.*
Seaman, William		Galls, &c.
Shaffer, J. M	Fairfield, Iowa	Skin of yellow-hammer, (*Colaptes auratus.*)
Sharp, S. W	Newville, Pa	Partridge; Cochin fowls.
Shortridge, J. H	Cottage Grove, Lane County, Oreg.	Digger-squirrel from Oregon.
Smithsonian Institution		Sample specimen of insects, plants, &c.; one wild Mexican turkey skin.
Do		Wheat and insects.
Do		Package insects from Dr. T. J. R. Keenan; insects Lieutenant F. Tuttle, U. S. revenue marine.
Stanton, Fred. J	Denver, Colo	Sample of wheat.
Stumps, J. M. L	Greensburgh, Pa	Galls on elm.
Talley, J. R	Plantersville, Ala	Red and white ear of corn.
Walker, R. L., M. D	Mansfield Valley P. O., Pa.	Arrow-points, butterflies, &c.
Whitaker, B	Warsaw, Ill	Specimens of apple and peach borers.
Do	do	Borers in apple and peach.

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